

# Computer Assisted Radiology

## Nowości na konferencji CARS 2008

**Interdyscyplinarne Seminarium Przetwarzania, Analizy  
i Interpretacji Obrazów w Medycynie**

10 października 2008

**Bartosz Borucki**

Interdyscyplinarne Centrum Modelowania  
Matematycznego i Komputerowego  
Uniwersytet Warszawski



- Konferencja CARS 2008
- Computed Assisted Radiology
  - Digital Imaging
  - Computed Tomography
  - Magnetic Resonance
  - Cardiac and Vascular Imaging
  - Computer Assisted Radiation Therapy
  - Image Processing and Display
- Wnioski

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- **CARS 2008 congress**

- Computer Assisted Radiology and Surgery
- Barcelona, Spain, 25-28 June 2008

- Main themes:

- Medical Imaging
- Cardiovascular Imaging
- Computed Maxillofacial Imaging
- Image Processing and Display
- PACS and IHE
- Telemedicine and E-Health
- Computer Aided Diagnosis
- Computer Assisted Radiation Therapy
- Surgical Navigation
- Surgical Robotics and Instrumentation
- Surgical Simulation and Education
- Computer Assisted Orthopaedic and Spinal Surgery
- Computer Assisted Head and Neck, and ENT Surgery
- Image Guided Neurosurgery
- Minimally Invasive Cardiovascular and Thoracoabdominal Surgery

- **CARS 2008 congress**
  - **22<sup>nd</sup> International Congress and Exhibition on Computer Assisted Radiology (CAR)**
  - 12<sup>th</sup> Annual Conference of the International Society for Computer Aided Surgery (ISCAS)
  - 26<sup>th</sup> International EuroPACS Meeting
  - 10<sup>th</sup> International Workshop on Computer-Aided Diagnosis (CAD)
  - 14<sup>th</sup> Computed Maxillofacial Imaging Congress
  - 9<sup>th</sup> CARS / SPIE / EuroPACS Joint Workshop on Surgical PACS and the Digital Operating Room
  - Japanese Institutes of CARS (JICARS)

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# Computer Assisted Radiology - DI

## • Digital Imaging – DI

- **What has been the impact of computed-assisted radiology and surgery on learning human anatomy?**  
S. Golding, Univ. of Oxford, Headington, E.B. Beckmann, Lanmark Medical Education Ltd., Beaconsfield (UK)
- **Simplifying image oriented [quality control](#) in [digital mammography](#)**  
J. Jacobs, T. Deprez, A. Van Steen, C. Van Ongeval, E. Bellon, G. Marchal, H. Bosmans, Univ. Hosp. Leuven (B)
- **An online decision support system for automatic breast tumor classification of digital mammograms**  
M. Skevofilakas, E.N. Tsetsou, K.S. Nikita, National Technical Univ. of Athens (GR)
- **Detecting clipped anatomy in [chest radiographs](#)**  
H. Luo, J. Ellinwood, D. Foos, Carestream Health, Inc., Rochester, NY, E. Siegel, B. Reiner, Univ. of Maryland, Baltimore, MD (USA)
- ✓ **Development of a pulmonary functional imaging using a dynamic Flat-Panel Detector (FPD): primary results of clinical evaluation in pulmonary diseases**  
R. Tanaka, S. Sanada, M. Fujimura, M. Yasui, O. Matsui, Kanazawa Univ., T. Matsui, N. Hayashi, Y. Nanbu, Kanazawa Univ. Hosp. (J)
- **Functional lowdose digital radiography versus HRCT in diagnosis of COPD treatment efficiency**  
N. Gorbunov, State Medical Univ., Novosibirsk (RUS)
- ✓ **Noise and contrast variation in a large sample of panoramic and cephalometric digital images**  
L. Bondioli, G. Mariotti, Radmedica SAS, Rome, C.C. Bianchi, S.D. Bianchi, Univ. of Turin (I)
- **PETQc: combining software and innovative phantom for a weekly PET quality control**  
M. Vermandel, R. Jounwaz, N. Betrouni, J. Rousseau, INSERM, Lille, X. Marchandise, D. Huglo, Univ. Hosp. of Lille, L. Fin, North Univ. Hosp., Amiens, S. Hapdey, Univ. of Rouen (F), A. Bol, St. Luc Univ. Hosp., Brussels (B)
- **A method for slice profile characterization and slice thickness measurement of ultrasonic images**  
N. Betrouni, M. Vermandel, R. Lopes, R. Viard, P. Puech, J. Rousseau, INSERM, Lille (F)
- **Assessment of [quality control](#) in US: a web service for preventive maintenance**  
L. Pecchia, S. Torino, M. Bracale, Univ. Federico II of Naples, L. Mirarci, Siemens Medical Solutions, Naples (I)



# Digital Imaging

- **A method for slice profile characterization and slice thickness measurement of ultrasonic images**

N. Betrouni, M. Vermandel, R. Lopes, R. Viard, P. Puech, J. Rousseau, INSERM, Lille (F)

- Ultrasonic imaging
- 3D US – system for image acquisition, probe position acquisition, image reconstruction, 3D visualization
- Many existing techniques
- US generates images with a defined slice thickness along the US beam
- 3D reconstruction methods does not take this information into account
- Only few published methods for evaluating slice thickness
- Introduction of a phantom and a method for characterizing slice profile and estimating slice thickness at any exploration depth
- Improvement of the performance of the 3D reconstruction esp. For small volumes

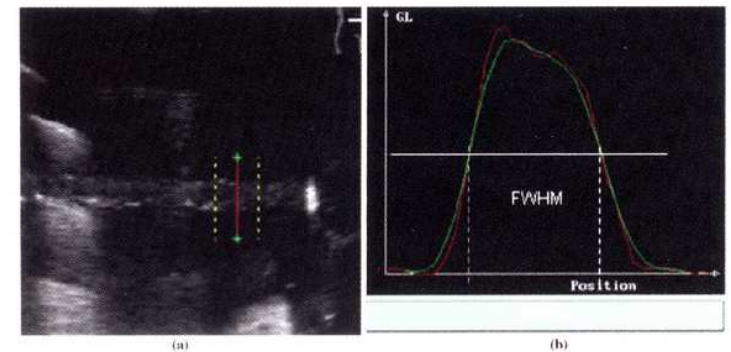
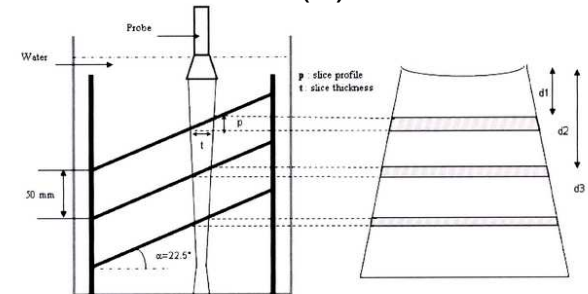
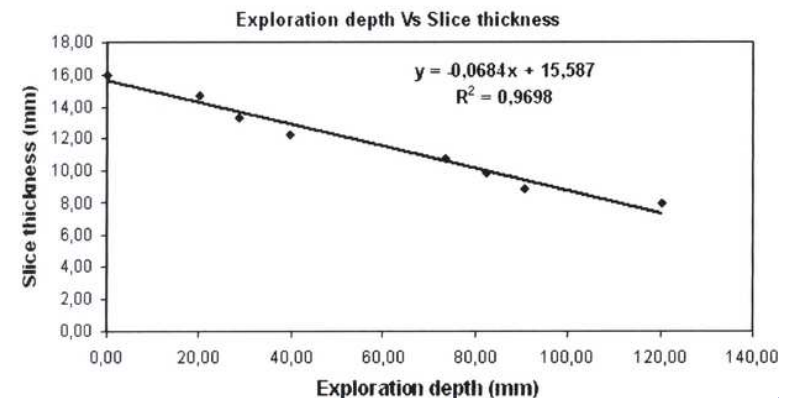


Fig. 3 Slice profile estimation for a given depth. (a) Trace generated by the plane in the image and the grey scale distribution for this trace.



# Plan prezentacji

- Konferencja CARS 2008
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# Computer Assisted Radiology - CT

- **Computed Tomography – CT**

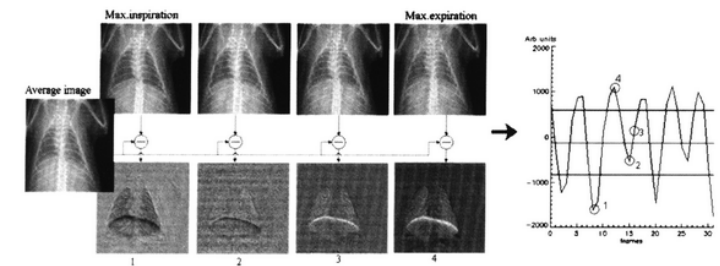
- **A new algorithm for ring [artifact reduction](#) in cone-beam computed tomography: preliminary results**  
M. Abella Garcia, J.J. Vaquero López, A. Sisniega Crespo, M.L. Soto-Montenegro, M.Desco Menéndez, General Univ. Hosp. Gregorio Maranon, Madrid (E)
- ✓ **Correction of cupping artifact for cone-beam micro-CT imaging**  
I. Vidal Migallon, M. Abella Garcia, A. Sisniega Crespo, J.J. Vaquero López, M. Desco Menéndez, General Univ. Hosp. Gregorio Maranon, Madrid (E)
- ✓ **Reduction of [respiratory blurring](#) in small-animal CT scans based on a fast retrospective gating method**  
C. Chavarrias, J.J. Vaquero López, A. Sisniega Crespo, A. Rodriguez, M.L. Soto-Montenegro, M. Desco Menéndez, General Univ. Hosp. Gregorio Maranon, Madrid (E)
- **Demonstration of intramyocardial fat deposition by multi-detector computed tomography**  
F. Saremi, S. Channal, M. Talebmehr, G. Swaminatha, S. Kenchaiah, A. Raney, Univ. of California, Irvine, Orange, CA (USA)
- **OSEM reconstruction algorithm for fluorescence molecular tomography: a preliminary study**  
J. Aguirre, M. Abella Garcia, J.J. Vaquero López, M. Desco Menéndez, General Univ. Hosp. Gregorio Maranon, Madrid (E), J. Ripoll, FORTH – Foundation of Research and Technology, Heraklion (GR)

# Computer Assisted Radiology - CT

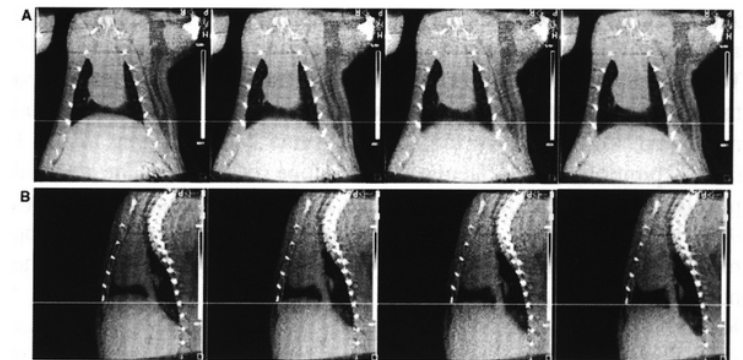
- **Reduction of respiratory blurring in small-animal CT scans based on a fast retrospective gating method**

C. Chavarrias, J.J. Vaquero Lñpez, A. Sisniega Crespo, A. Rodriguez, M.L. Soto-Montenegro, M. Desco Menéndez, General Univ. Hosp. Gregorio Maranon, Madrid (E)

- Influence of respiratory motion on CT projections and reconstruction – blurring, artifacts
- Literature methods
  - Prospective
    - acquisition is synchronized with the patient breath
    - all projections are obtained at the same respiratory phase
    - external tracking of the respiratory signal
  - Retrospective
    - No triggering during acquisition
    - Frames classified to different respiratory phases
      - By the use of external respiratory signal
      - By the use of image processing techniques
- Development of a fast retrospective method to extract the respiratory signal from CT projections in cone beam geometry
- Dynamic breathing studies in small animal scans
- Software-based, automatic process
- No usage of external gating mechanisms



**Fig. 1** Moving areas highlighted by subtracting the average image. Zero value pixels are represented in grey, positive and negative values are brighter and darker, respectively. On the left, four examples of difference images: frame 8 at maximum inspiration, frame 15 and 16 corresponding to mid-stages and frame 12 corresponding to maximum expiration. On the right, the respiratory signal obtained by adding all the pixel values in each image



**Fig. 2** Dynamic study. Horizontal axis represents time. A) shows coronal slices and B) sagittal ones. The white lines have been drawn over the slices as a spatial reference

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- **Magnetic Resonance – MR**

- **Could 3DAC image predict the outcome of motor function in patients with cerebral infarction?**  
K. Igase, I. Matsubara, M. Arai, J. Goishi, K. Sadamoto, Washokai Sadamoto Hosp., Matsuyama (J)
- **Volume measurement of functional [brain images](#) for patients with drug addiction: preliminary results**  
D.-S. Yoo, S.Y. Lee, J.-W. Jeong, J.W. Lee, S. Kim, Electronics and Telecommunications Research Inst., Daejeon, I.-S. Kim, Y. Chang, Kyungpook National Univ., Daegu (ROK)
- **Spectroscopy analysis in pediatric metabolic brain diseases**  
J. Alirezaie, S. Zarei Mahmoodabadi, Ryerson Univ., P. Babyn, E. Widjaja, The Hosp. For Sick Children, Toronto, Ontario, A. Kassner, Univ. of Toronto (CDN)
- **Clinical validation of [fiber tract](#) modeling based on tensor field interpolation via symptom-topography correlation test**  
Y. Masutani, D. Ito, S. Aoki, O. Abe, N. Hayashi, K. Ohtomo, The Univ. of Tokyo Hosp. (J)
- **Image quality in non-gated versus gated reconstruction of tongue motion using Magnetic Resonance Imaging (MRI): a comparison using automated image processing**  
G. Kochanski, C. Alvey, C. Orphandou, J. Coleman, S. Golding, Univ. of Oxford, A. McIntyre, Churchill Hosp., Oxford (UK)
- **Advanced viewing and information access through role-based, contextsensitive and knowledge-driven portals**  
H. Primo, Siemens Medical Solutions, Inc., Malvern, PA (USA)

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# Computer Assisted Radiology - CVI

- **Cardiac and Vascular Imaging – CVI**

- ✓ • **Determination of local motion vector fields for cardiac CT reconstruction**  
C. Bontus, U. van Stevendaal, M. Grass, Philips Research, Hamburg, O. Dössel, Technical Univ. of Karlsruhe (D), C. Schirra, King's College, London (UK)
- ✓ • **Diagnosis of patent foramen ovale with 64-slice MultiDetector Computed Tomography (MDCT)**  
F. Saremi, S. Channual, M. Talebmehr, A. Raney, G. Swaminatha, J. Narula, J. Milliken, A. Abolhoda, Univ. of California, Irvine, Orange, CA (USA)
- **Assessment of left ventricular wall motion in patients submitted to resynchronization therapy**  
M.A. Gutierrez, M.S. Rebelo, S.S. Brandao, M.C. Giorgi, J.C. Meneghetti, Univ. of Sao Paulo (BR), A.K. Aarre, K.-L. Clemmesen, Aalborg Univ. (DK)
- **An interactive software module for visualizing coronary arteries in CT angiography**  
C. Wang, A. Persson, Ö. Smedby, Linköping Univ. Hosp., H. Frimmel, Univ. of Uppsala (S)
- **3D rotational coronary angiography: projection-based motion compensation and automatic optimum phase selection**  
E. Hansis, D. Schäfer, M. Grass, Philips Research Europe, Hamburg, O. Dössel, Technical Univ. of Karlsruhe (D)
- **Whole body MRA of a widespread aortitis in rheumatic arthritis with the new blood pool contrast medium Vasovist (Gadofevset)**  
G. Fenzl, F. Schaeffer, H. Wilmowsky, Knappschaftskrankenhaus Püttlingen (D)
- **Superficial vascular imaging system using near infrared radiation and tomosynthesis algorithm, Tuned-Aperture Computed Tomography**  
Y. Hayakawa, Y. Miyoseta, H. Yamashita, M. Sagawa, T. Kawaguchi, Kitami Inst. Of Technology, Hokkaido (J)

# Computer Assisted Radiology – CVI

- **Cardiac and Vascular Imaging – CVI c.d.**



- **Real time enhancement of Digital Subtraction Angiographic (DSA) data acquired using C-arm X-ray imaging system**  
S. Zhao, L. Wei, J. Suri, Eigen LLC, Grass Valley, CA (USA)
- **Computational mapping of carotid atherosclerosis using magnetic resonance imaging: initial results and [comparison with 3D ultrasound](#)**  
G. Parraga, B. Chiu, A. Krasinski, A. Fenster, Robarts Research Inst., London, Ontario (CDN)
- **Quantitative cerebral blood flow measurement using mobile xenon-CT during temporary balloon occlusion of the internal carotid artery**  
C.L. Taylor, H. Yonas, Univ. of New Mexico School of Medicine, Albuquerque, NM (USA)
- **Assessment of automatic classification of artery plaque composition in IVUS images using histology correlation**  
A. Taki, P. Heider, N. Navab, Technical Univ. Munich, Garching (D), A. Roodaki, S. Setarehdan, Univ. of Tehran (IR)



# Cardiac and Vascular Imaging

- **Diagnosis of patent foramen ovale with 64-slice MultiDetector Computed Tomography (MDCT)**

F. Saremi, S. Channual, M. Talebmehr, A. Raney, G. Swaminatha, J. Narula, J. Milliken, A. Abolhoda, Univ. of California, Irvine, Orange, CA (USA)

- PFO is quite common in the general population
- Atrial shunting via a PFO has been associated with several pathologies
- Percutaneous closure techniques
  - Risk of significant complications
  - Demands precise anatomic characterization
- Contrast TEE – invasive method for diagnosis of right to left PFO shunts
- Investigation of feasibility of 64-slice MDCT to
  - Demonstrate anatomic detail of the interatrial septum pertinent to the PFO, associated anomalies, and morphologic variations during the cardiac cycle
  - Visual detection of left to right PFO shunts and comparison of results with TEE

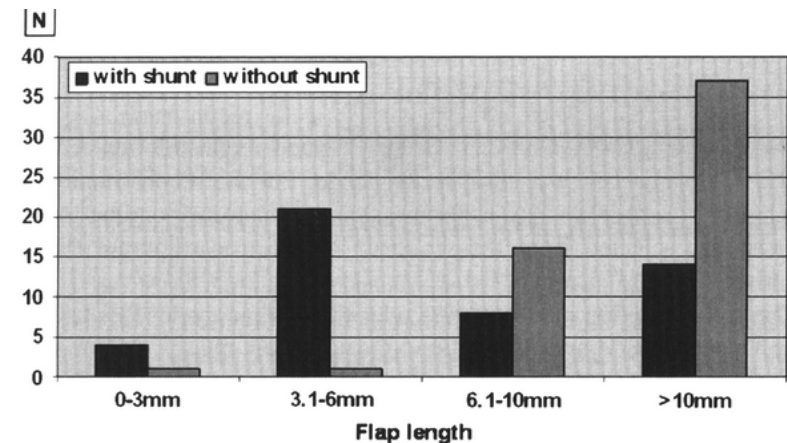


Fig. 1 Comparison of the number (N) of patients with or without PFO shunt in those with a mean free flap length between 0–3 mm, 3.1–6 mm, 6.1–10 mm, and > 10 mm

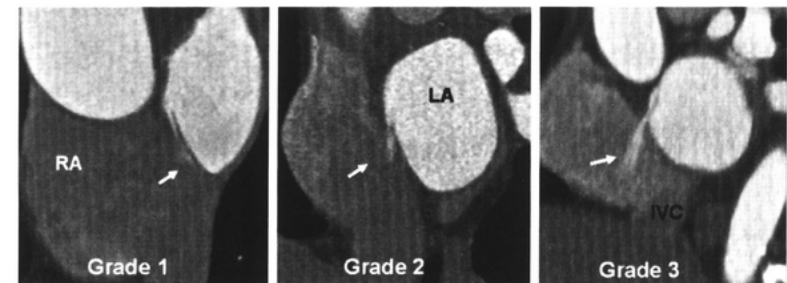


Fig. 2 Short axis images of coronary CTA at the level of the fossa ovalis in three different patients demonstrate the PFO tunnel filled with contrast. The entrance of the tunnel into the right atrium is patent causing a left to right shunt. The length of the contrast jet was measured and graded into three groups. Refer to the text for detail

# Cardiac and Vascular Imaging

- **Assessment of left ventricular wall motion in patients submitted to resynchronization therapy**

M.A. Gutierrez, M.S. Rebelo, S.S. Brandao, M.C. Giorgi, J.C. Meneghetti, Univ. of Sao Paulo (BR), A.K. Aarre, K.-L. Clemmesen, Aalborg Univ. (DK)

- Use of velocity information to assess some aspects of CRT (Cardiac Resynchronization Therapy)
- Color coded visualization scheme for the semi quantitative analysis of the cardiac left ventricle velocity components obtained in SPECT images
- Velocity fields obtained using classical 2D optical flow scheme and its 3D extension
- Three movement directions
  - Radial: contraction/expansion
  - Horizontal rotation: clockwise/counter-clockwise
  - Vertical rotation: upwards/downwards
- Qualitative assessment of the method performed using 3D gated-SPECT
- Radial motion and horizontal rotation can be used in the measurement of the effectiveness of CRT while horizontal and vertical rotations might predict a non-responder subject

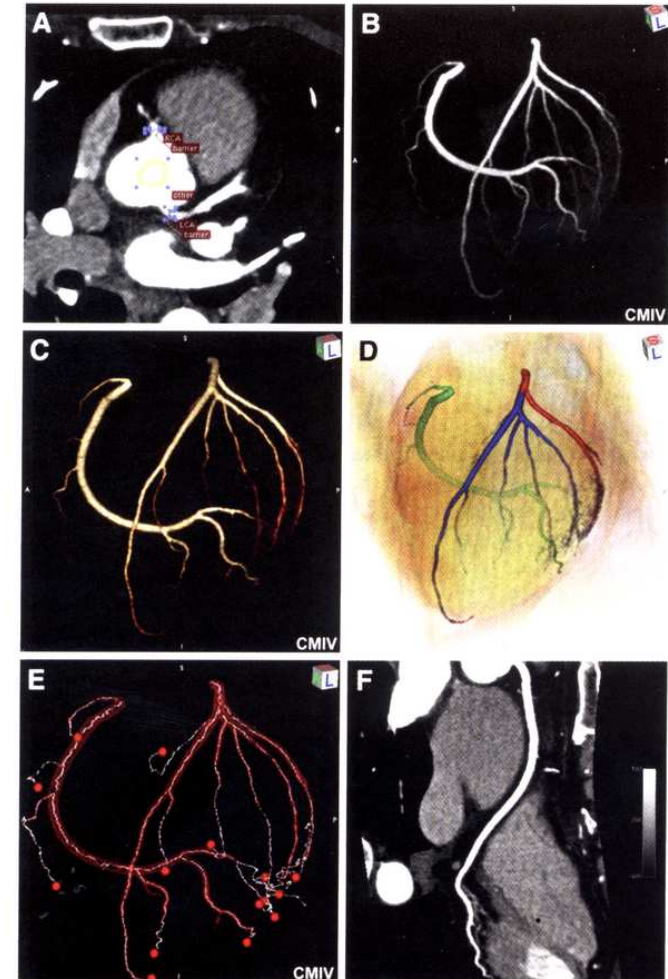


# Cardiac and Vascular Imaging

- **An interactive software module for visualizing coronary arteries in CT angiography**

C. Wang, A. Persson, Ö. Smedby, Linköping Univ. Hosp., H. Frimmel, Univ. of Uppsala (S)

- New module for OSIRIX framework
- Coronary arteries segmentation and visualization in CT Angiography
- Segmentation function based on an optimized „virtual contrast injection” algorithm
- Other algorithms – aim to define exact border of the vessel
- This algorithm – keep a sufficient amount of myocardial tissue surrounding the vessel in the segmentation result – preservation of detailed information about the coronary artery tree



**Fig. 1** Samples of results: A: the seeds used for segmentation. B: MIP images of coronary arteries. C: VRT images of coronary arteries. D: tagged VRT images of coronary arteries and heart chambers. E: midlines (skeleton) of the coronary tree. F: curved MPR image of the right coronary artery. In this case, the initial segmentation was sufficient and no improvement needed

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# Computer Assisted Radiology – CART

- **Computer Assisted Radiation Therapy – CART**

- **Real-time control strategy for collision avoidance and seed deposition in EUCLIDIAN brachytherapy robotic system**  
I. Buzurovic, V. Mistic, T. Podder, Y. Hu, K. Yan, R. Valicenti, A. Dicker, Y. Yu, Thomas Jefferson Univ., Philadelphia, PA, E. Messing, D. Rubens, J. Strang, Univ. of Rochester Medical Center, L. Liao, Cooper Univ. Hosp., Camden, NJ (USA), W.-S. Ng, School of Mechanical and Aerospace Engineering, Singapore (SGP)
- **A family of linear algorithms for the prediction of respiratory motion in image-guided radiotherapy**  
F. Ernst, A. Schweikard, Univ. of Lübeck (D)
- **Virtual simulator for customized cancer radiation treatment planning**  
O. Kum, S. Kim, Kyungpook National Univ., Daegu, Y. Han, Sungkyunkwan Univ. School of Medicine, Seoul (ROK)
- **A simulation and training environment for robotic radiosurgery**  
A. Schläfer, Stanford Univ. (USA), J. Gill, A. Schweikard, Univ. of Lübeck (D)
- **DICOM handling tools for Geant4-based radiotherapy simulation**  
A. Kimura, Ashikaga Inst. of Technology (J)

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# Computer Assisted Radiology – IPD

- **Image Processing and Display – IPD**

- **Computed applications in [abdominal imaging](#)**

- P.R. Ros, Harvard Medical School, Boston, MA (USA)

- **Liver segmentation using a novel level set based shape prior method**

- L. Gu, K. Cheng, Shanghai Jiaotong Univ. (CHN)

- **Preliminary study for automated segmentation and classification of hepatic vessels in non-contrast X-ray torso CT images**

- X. Zhou, T. Kitagawa, T. Hara, H. Fujita, R. Yokoyama, H. Kondo, M. Kanematsu, H. Hoshi, Gifu Univ. Graduate School of Medicine (J)



- **Non-rigid registration of 3D ultrasound and CT images in the liver using intensity and gradient information**

- D. Lee, Y.S. Kim, J.H. Lee, J.B. Ra, Korea Advanced Inst. of Science & Technology (KAIST), Daejeon (ROK)

- **Evaluation of two liver lesion segmentation methods for volume measurement in contrast MDCT**

- H. Cheng, Hepatobiliary Eastern Hosp., Shanghai (CHN), X. Wang, S. Li, G. Wei, X. Zeng, H. Chen, C.-C. Liang, L. Fan, J. Qian, EDDA Technology, Princeton, NJ (USA)

- **A method for extracting pancreas regions from four-phase contrasted 3D abdominal CT images**

- T. Kitasaka, M. Sakashita, K. Mori, Y. Suenaga, Nagoya Univ., S. Nawano, International Univ. of Health and Welfare, Tokyo (J)

- **Automatic segmentation of the ribs and the vertebral column in computed tomographic images of pediatric patients**

- R. Rangayyan, S. Banik, Univ. of Calgary, G. Boag, Alberta Children's Hosp., Calgary, Alberta (CDN)

- **Time-resolved 3D rotational angiography reconstruction: towards cerebral aneurysm pulsatile analysis**

- J.M. Pozo, C. Zhang, M.-C. Villa-Uriol, M. De Craene, A. Frangi, Univ. Popeu Fabra, Barcelona (E)

- **Optimal linear transformation based fMRI feature space analysis**

- F. Sun, Shandong Univ. (CHN), D. Morris, P. Babyn, Hosp. for Sick Children, Toronto, Ontario (CDN)



# Computer Assisted Radiology – IPD

- **Image Processing and Display – IPD c.d.**

- **A new image-based diagnostic framework for early diagnosis of dyslexic brains**

A.S. El-Baz, M.F. Casanova, M. Mott, A.E. Switala, The Univ. of Louisville (USA), Georgy Gimel'farb, Univ. of Auckland (NZ)



- **Registration of a CT-like atlas to fluoroscopic X-ray images using intensity correspondences**

L. Joskowicz, A. Hurvitz, The Hebrew Univ. of Jerusalem (IL)



- **Log-Euclidean DT-MRI consistency as an independent measure for validation of inter-subject registration**

F.J. Sanchez Castro, J.-P. Thiran, Swiss Federal Inst. of Technology, Lausanne (CH), O. Clatz, J. Dauguet, S.K. Warfield, Children's Hosp., Boston, MA (USA)

- **Skewness reduction approach for measuring airway wall thickness**

J. Lee, A. Reeves, Cornell Univ., Ithaca, NY, D. Yankelevitz, C. Henschke, Weill Cornell Medical College, New York, NY (USA)

- **Model-based three-dimensional breast shape reconstruction from two mammogram views**

W.-J. Kuo, B.-Y. Huang, Yuan Ze Univ., Chung-Li (RC), W.K. Moon, Seoul National Univ. Hosp. (ROK)



- **Automatic generation of exploration paths for medical models**

P.P. Vázquez Alcocer, I. Navazo, Politechnical Univ. of Catalonia, E. Monclús, Inst. Of Robotics and Industrial Informatics, J. Herrero, CM Teknon, J. López, ALMA IT Systems, Barcelona (E)

- **Correction of images in an open-configuration MR imaging system for radiation therapy planning and Interventional MRI**

R. Viard, S. Mordon, N. Betrouni, M. Vermandel, M. Vanhoutte, J. Rousseau, INSERM, Lille (F)

- **Color properties of displays for medical application**

H. Roehrig, W. Dallas, Univ. of Arizona, Tucson, AZ (USA)

- **The medical imaging informatics appliance**

J.W. Cooper, S. Ebadollahi, E. Eide, G. Iyengar, C. Neti, IBM T.J. Watson Research Center, Hawthorne, NY (USA)



# Image Processing and Display

- **Liver segmentation using a novel level set based shape prior method**

L. Gu, K. Cheng, Shanghai Jiaotong Univ. (CHN)

- Abdomed MRI images
- Level-set segmentatytion methods often fail – occluded objects, low gray contrasts, missing contrasts
- Prior shape methods
  - Limitations: no model shape translations/rotations/scaling, exact location of prior shapes,
- Novel method based on CV model (Chan-Vese's segmentation model) with translations, rotations and scaling
  - Feature image
  - Initial segmentation based on CV model + labeling function
  - Training of shape model – matching prior shape model to the initial segmentation
  - Prior shape model based on manual segmentations
- 2D

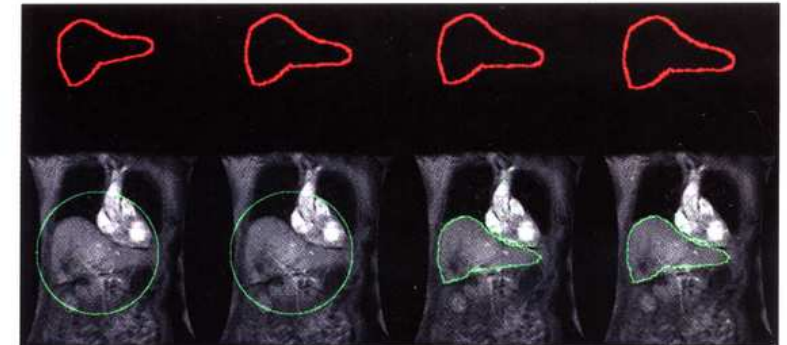


Fig. 1

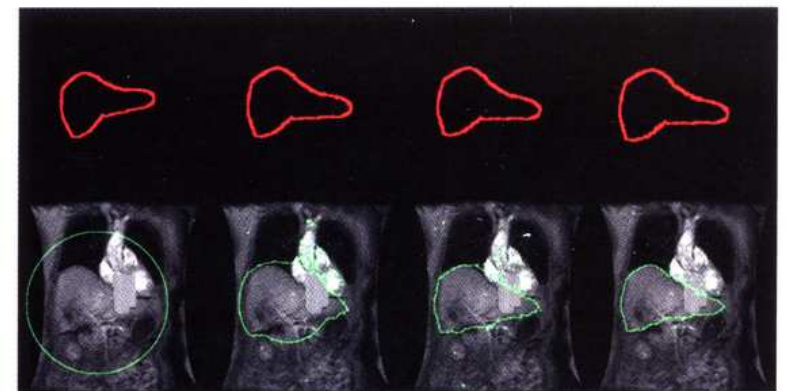


Fig. 2

# Image Processing and Display

- **Non-rigid registration of 3D ultrasound and CT images in the liver using intensity and gradient information**

D. Lee, Y.S. Kim, J.H. Lee, J.B. Ra, Korea Advanced Inst. of Science & Technology (KAIST), Daejeon (ROK)

- Registration of preoperative (CT) and intraoperative images (US)
- Local deformations due to respiration
- Different modality – different characterization of image
- Most methods based on vessel information – registration strongly depends on vessel segmentation both in CT and US images
- Image-based non-rigid registration between 3D US and CT images in the liver
- Incorporates both vessel and diaphragm information
- Objective function based on a joint histogram of intensity and gradient information
- Initial affine registration + Free Form Deformation
- Different objective function for the diaphragm (intensity in US and gradient magnitude in CT) and vessels (intensities in US and CT)
- 3D joint histogram is based on intensities and edge orientation

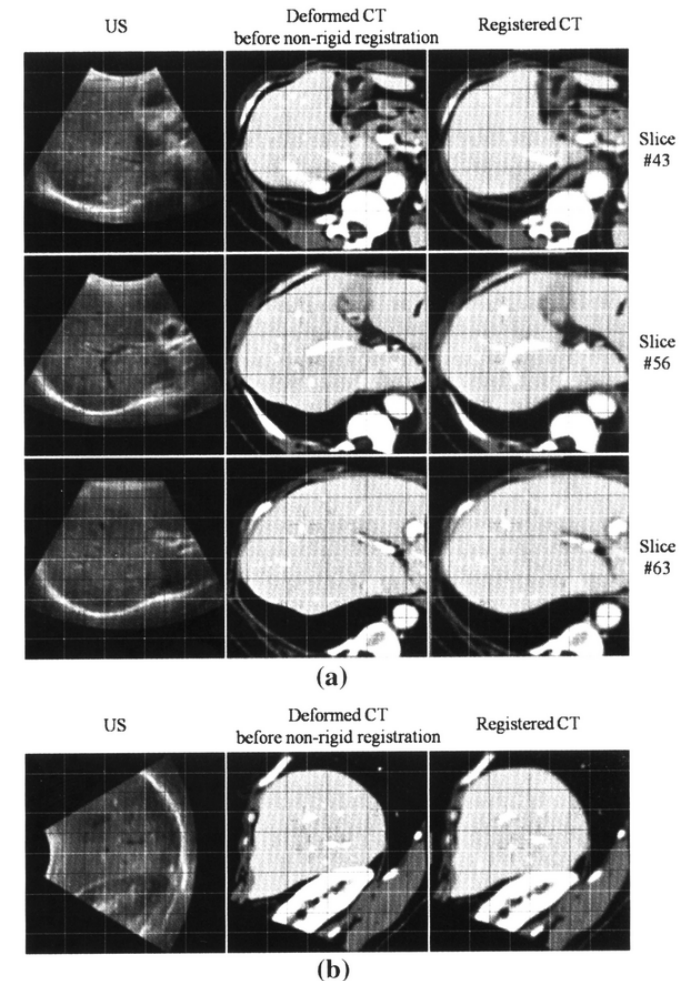


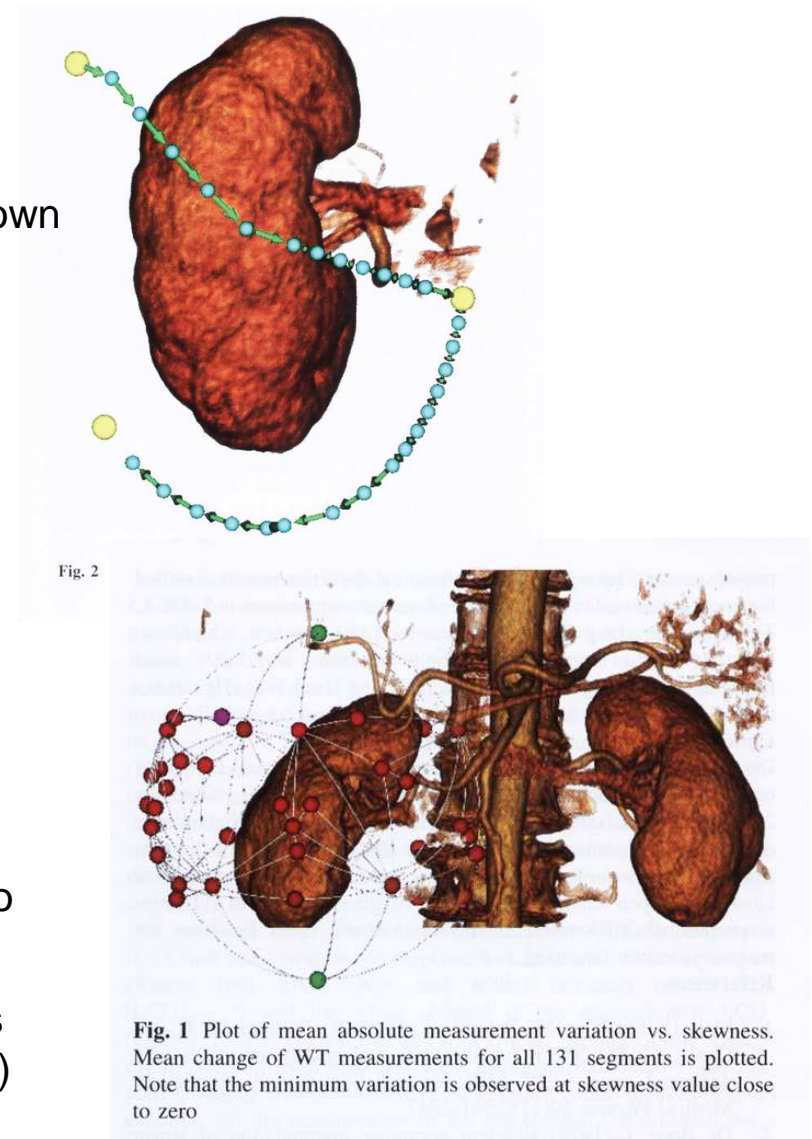
Fig. 1 Non-rigid registration between a 3D US image and a synthetically deformed CT image; (a) axial slices, (b) a sagittal slice

# Image Processing and Display

- **Automatic generation of exploration paths for medical models**

P.P. Vázquez Alcocer, I. Navazo, Politechnical Univ. of Catalonia, E. Monclús, Inst. Of Robotics and Industrial Informatics, J. Herrero, CM Teknon, J. López, ALMA IT Systems, Barcelona (E)

- Technique to help specialists find adequate views of the datasets
- Finding camera paths (exploration paths) to maximize the shown information
  - whole dataset
  - region of interest
- Framework to animate medical visualization
- Steps
  - Model from volume data
  - Best view of model
  - Differently looking views
  - Path that visits calculated views with speed adaptation to the amount of information
- The measure of „the best view” and „maximum information” is the information transfer function (which can be also redefined)

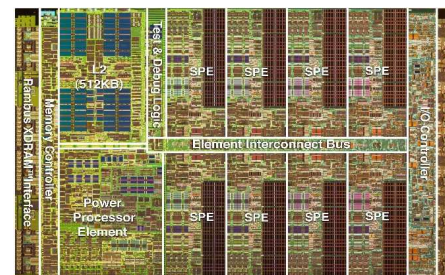


# Image Processing and Display

- **The medical imaging informatics appliance**

J.W. Cooper, S. Ebadollahi, E. Eide, G. Iyengar, C. Neti, IBM T.J. Watson Research Center, Hawthorne, NY (USA)

- System for medical records management
- Multimodal imaging data
- Cell Broadband Engine processors as a high-performance image analytics platform
- E.g. image registration deployed to Cell platform



- Konferencja CARS 2008
- Computed Assisted Radiology
  - Digital Imaging
  - Computed Tomography
  - Magnetic Resonance
  - Cardiac and Vascular Imaging
  - Computer Assisted Radiation Therapy
  - Image Processing and Display
- **Wnioski**

- Mało algorytmów „czysto” 3D
  - Często 3D = 2,5D – slice’y
  - Z wyjątkiem rekonstrukcji serca i wirtualnej kolonoskopii
- Dużo prac „implementacyjnych” – przegląd wyników metody
- Kilka prac na bardzo niskim poziomie
  
- Częste pytania: Jaka dokładność jest konieczna do zastosowań klinicznych? Po co aż tak dokładna metoda?
- Quality control – algorytmy przetwarzania danych obrazowych
  
- Największe zainteresowanie
  - Rekonstrukcja ruchu serca
  - Prezentacje algorytmiczne
  - Radiologists + image processing guys
  
- Miejsce Polski – znikome, jedynie PACS (prof. Ewa Piętka, PŚ)
- Jest miejsce dla nas!

# CARS 2009




**CARS 2009**  
Computer Assisted  
Radiology and Surgery  
23<sup>rd</sup> International Congress and Exhibition

June 23–27, 2009  
Berlin, Germany

**Main Themes**

- Medical Imaging
- Cardiovascular Imaging
- Computed Maxillofacial Imaging
- Image Processing and Display
- PACS and IHE
- Telemedicine and E-Health
- Computer Aided Diagnosis
- Computer Assisted Radiation Therapy
- Model Guided Therapy
- Surgical Navigation
- Surgical Robotics and Instrumentation
- Surgical Simulation and Education
- Computer Assisted Orthopaedic and Spinal Surgery
- Computer Assisted Head and Neck, and ENT Surgery
- Image Guided Neurosurgery
- Minimally Invasive Cardiovascular and Thoracoabdominal Surgery

**Deadline for abstract/paper submission:**  
10<sup>th</sup> January 2009  
[www.cars-int.org](http://www.cars-int.org)

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CARS 2010 >> Geneva, Switzerland

**23<sup>rd</sup> International Congress and Exhibition on Computer Assisted Radiology (CAR)**  
Chairman: Stanley Baum, MD (USA)  
Co-chair: Bernd Hamm, MD (D)

- Medical Imaging, e.g. CT, MR, US, SPECT, PET, DR, Molecular Imaging, and Virtual Endoscopy
- Computer Assisted Cardiovascular Imaging
- Image Processing and Display
- Medical Workstations
- Interventional Radiology
- Minimally Invasive Spinal Therapy
- Image Guided Diagnosis and Therapy of the Prostate
- Ablation Therapies
- Image Guided Radiation Therapy
- Nanotechnology for Imaging and Therapy
- Telemedicine, E-health and Multimedia EPR
- Expert Systems and Computer Assisted Education
- Economic and Management Issues
- Security, Legal and Ethical Aspects

**13<sup>th</sup> Annual Conference of the International Society for Computer Aided Surgery (ISCAS)**  
President: Gero Strauss, MD (D)

- Computer Applications for e.g. Neurosurgery, Head and Neck, Orthopaedics, Ear Nose and Throat, Cardiovascular and Thoracoabdominal Surgery, and Plastic/Reconstructive Surgery
- Image Guided Therapy
- Image Processing and Visualization
- Surgical Robotics and Instrumentation
- Surgical Navigation
- Surgical Simulation
- 3D Modelling and Rapid Prototyping
- Postoperative Result Assessment
- Surgical Education and Training
- Haptics and Multimodal Devices in Medical Applications
- Methods of Validation and Verification

**11<sup>th</sup> International Workshop on Computer-Aided Diagnosis (CAD)**  
Chairman: Kunio Doi, PhD (USA)  
Co-chair: Ulrich Bick, MD (D)

- CAD for Breast, Chest, Colon, Skeletal, Liver, Brain and Vascular Imaging
- CAD for Cancer Screening
- CAD for 3D Imaging
- CAD for Differential Diagnosis
- Image Databases for CAD
- Computer Vision, AHN and Modelling
- Computerized Detection and Characterization of Lesions in Radiological Images
- Quantitative Analysis of Image Information
- Visualization and Quantitation of 3D Images
- Intelligent Workstations and Decision Support Systems
- Observer Performance Studies and ROC Analysis
- Image Quality Issues and Evaluation

**15<sup>th</sup> Computed Maxillofacial Imaging Congress (CMI)**  
Chairman: Allan G. Farman, PhD, DSc (USA)

- New Imaging Devices and Novel Applications
- Evidence-based Selection Criteria in Digital Maxillofacial Imaging
- Cranio-maxillofacial Computer-Aided Diagnosis
- Maxillofacial Image Enhancement Algorithms
- Cranial and Maxillofacial Image Guided Surgery
- Image Navigated Dental Implantology
- Orthodontic Applications of Computed Imaging
- Imaging and Modelling for Maxillofacial Prosthodontics
- Cone Beam CT
- 3D and 4D Imaging
- Multi-dimensional Maxillofacial Modelling
- Virtual Reality and Dental Robotics
- Interoperability
- Maxillofacial Applications in Integrating the Healthcare Enterprise

**27<sup>th</sup> International EuroPACS Meeting**  
President: Osmar M. Rabb, MD, PhD (CH)

- PACS Planning and Purchasing Strategies
- PACS Evaluation and Economical Aspects
- PACS Beyond Radiology (Cardiology, Endoscopy, Ophthalmology, etc.)
- Image Distribution, Storage and Archiving Strategies
- Workflow and Data Flow in Radiology
- PACS/RIS/HIS Integration Issues
- Regional PACS and Tele-radiology
- Cross-Border Experiences
- Security and Privacy, Quality Assurance, Legal Aspects
- Standardization (DICOM, HL7, IHE)
- PACS and E-Learning in Radiology and Medical Sciences

**8<sup>th</sup> Annual Meeting of CURAC – Deutsche Gesellschaft für Computer- und Roboter-Assistierte Chirurgie e. V.**  
President: Volkmur Falk, MD (D)

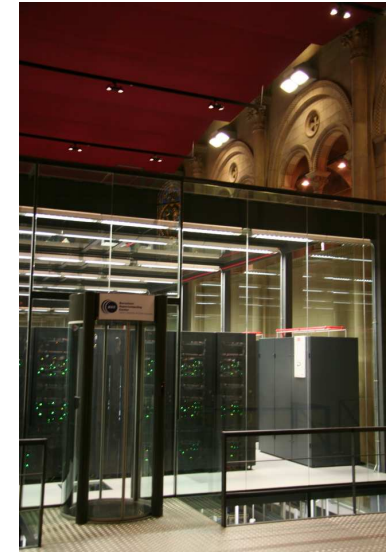
- Patient Specific Modelling
- Model Guided Therapy
- Intelligent Surgery
- Workflow Management
- Navigated Control

**10<sup>th</sup> CARS/SPIE/EuroPACS Joint Workshop on Surgical PACS and the Digital Operating Room**  
Chairman: Osman M. Rabb, MD, PhD (CH)  
Heinz U. Lemke, PhD (D)

- Surgical Workflow
- Digital Operating Room
- Model Guided Therapy
- Therapy Imaging and Model Management Systems
- Surgical PACS
- DICOM in Surgery



# Dziękuję za uwagę



***PYTANIA ?  
KOMENTARZE?***

