9TH MICCAI CONFERENCE

MICCAI 2006 Workshop Programme

FROM STATISTICAL ATLASES TO PERSONALIZED MODELS: UNDERSTANDING COMPLEX DISEASES IN POPULATIONS AND INDIVIDUALS

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Copenhagen, Denmark

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FROM STATISTICAL ATLASES TO PERSONALIZED MODELS: UNDERSTANDING COMPLEX DISEASES IN POPULATIONS AND INDIVIDUALS

Satellite Workshop – October 6th - MICCAI 2006 – Copenhagen, Denmark

Chairmen: A.F. Frangi (UPF), H. Delingette (INRIA)

08:00-09:00: Registration

08:45-09:00: Workshop opening

09:00-09:40: Invited Lecture: *Computational Hemodynamics and Vascular Disease: From Pretty Pictures to Hypothesis Testing.* David Steinmann. *Biomedical Simulation Lab, Mechanical & Industrial Engineering University of Toronto, Canada.*

The putative role of vascular geometry and hemodynamics in the development of vascular disease remains unclear, largely owing to a lack of hard evidence from prospective human studies. Such studies are now possible, however, through the integration of medical imaging and computational fluid dynamics, so-called image-based CFD. Still, these technical developments have raised questions about how to deal with the wealth of temporally and spatially-varying vascular anatomic and hemodynamic data, from multiple subjects and at multiple time points. In this presentation, I will review the development and application of image-based CFD itself, and then discuss how we and others have tried to develop and apply spatial mapping techniques to quantify changes within individual subjects, and similarities and differences across subjects, in a statistically meaningful manner. I will also discuss important practical issues related to inherent uncertainties in both the magnitude and location of derived hemodynamic quantities. It is hoped that this presentation will stimulate cross-fertilization of ideas and techniques from other applications coping with similar challenges.

09:40-10:40: Physiological modelling, simulation and integrative perspectives

1- ***Estimation of Disease State Using Statistical Information from Medical Imaging Data.***

J. Koikkalainen[1], J. Lötjönen[1], S. Kivistö[2], M. Antila[2] and S. Toiviainen-Salo[2]

[1]VTT Technical Research Centre of Finland, Tampere, Finland; [2]Helsinki Medical Imaging Center, Helsinki University, Helsinki, Finland.

2- ***Towards an Electrophysiological Functional Atlas of the Uterus in Premature and Full Term Labour.***

A.V. Holden[1], P. Li[1], A.M. Blanks[2], C.J. Evans[3], S. Kharche[4], N.A.B Simpson[5], S. Smye[3] S. Snowden[3], M.J. Taggart[6], J.J. Walker[5] and H. Zhang[4]

[1]Institute of Membrane and Systems Biology, University of Leeds, Leed, United Kingdom; [2]Medical School, University of Warwick, United Kingdom; [3]Medical Physics, St James University Hospital, Leeds United Kingdom; [4]Department of Physics and Astronomy, University of Manchester, Manchester United Kingdom; [5]Obstetrics and Gynaecology, School of Medicine, University of Leeds, Leeds United Kingdom; [6]Maternal and Fetal Health Research Centre, University of Manchester, Manchester United Kingdom.

10:40-11:00: Coffee break & Poster session: Methods

1- ***A Comparative Study of Statistical Separating Hyperplanes in Extracting Discriminative Information from Medical Images.***

C.E. Thomaz[1], D.F. Gillies[2] and D. Rueckert[2]

[1]Department of Electrical Engineering, Centro Universitario da FEI, Sao Paulo, Brazil; [2]Department of Computing, Imperial College, London, United Kingdom.

2- ***Shape-Driven Surface Segmentation Using Spherical Wavelets.***

D. Nain[1], S. Haker[2], A. Bobick[1], and A. Tannenbaum[3]

[1]College of Computing, Georgia Institute of Technology, Atlanta, United States of America; [2]Department of Radiology, Surgical Planning Laboratory, Brigham and Women's Hospital, Boston, United States of America; [3]Electrical Engineering, Georgia Institute of Technology, Atlanta, United States of America.

3- ***Automated 3D Rigid Registration of Open 2D Manifolds.***

S. Darkner[1, 2], M. Vester-Christensen[1], R. Larsen[1], C. Nielsen[2] and R.R. Paulsen[2]

[1]IMM, DTU, Denmark; [2]Oticon A/S, Denmark.

4- ***An Information-Theoretic Based Method for Constructing the Complex Brain Functional Network with fMRI and the Analysis of Small World Property.***

M. Liang[1], T. Jiang[1], L. Tian[1], B. Liu[1], Y. Zhou[1], H. Liu[2], F. Kuang[2] and Z. Liu[2]

[1]National Laboratory of Pattern Recognition, Institute of Automation, Chinese Academy of Sciences, PR China; [2]Institute of Mental Health, Second Xiangya Hospital, Central South University, PR China.

11:00-12:00: Statistical Atlases of Structure and Function I: Oncology

1- ***Data-Fusion for Monitoring the Biomechanical Evolution of Biological Skeletal Reconstruction in Pediatric Oncology.***

F. Taddei[1], L. Montanari[1], A. Leardini[2], M. Viceconti[1] and M. Manfrini[3]

[1]Medical Technology Laboratory, Istituti Ortopedici Rizzoli, Bologna, Italy; [2]Movement Analysis Laboratory, Istituti Ortopedici Rizzoli, Bologna, Italy; [3]Department of Musculoskeletal Oncology, Istituti Ortopedici Rizzoli, Bologna, Italy.

2- ***Intra-Patient Anatomic Statistical Models for Adaptive Radiotherapy.***

S.M. Pizer1, R.E. Broadhurst1, Ja-Yeon Jeong1, Q. Han1, R. Saboo1, J. Stough1, G. Tracton1 and E.L. Chaney1

[1]Medical Image Display & Analysis Group, University of North Carolina, Chapel Hill, North Carolina, United States of America.

3- ***Evaluation of Atlas Construction Strategies in the Context of Radiotherapy Planning.***

O. Commowick[1,2] and G. Malandain[1]

[1]INRIA Sophia Antipolis Cedex, France; [2]DOSISoft S.A., Cachan, France.

12:00-13:30: Lunch

13:30-14:10 Invited Lecture: *Frontiers in Personalized Computational Modeling of Cardiac Electro – Mechanics.* Frank B. Sachse. *Cardiovascular Research and Training Institute, University of Utah, USA*

Computer-based models of cardiac diseases have been frequently developed to provide insights in the underlying pathophysiological mechanisms. These insights have been successfully applied in the areas of clinical cardiology and heart surgery as well as for development of biomedical instrumentation and in pharmacology.

The lecture will present approaches and applications of computational models of cardiac electro-mechanics with focus on personalized models. I will give an introduction to mathematical modeling approaches from protein to whole organ level. Particularly, Markov and Hodgkin-Huxley type approaches for electrophysiological modeling of normal and mutated ion channels will be presented.

Several simulation studies of cardiac diseases and wounds will be discussed. These studies indicate the potential, but also the frontiers of personalized computational modeling.

14:10-15:10: Statistical Atlases of Structure and Function II: Neurology

1- ***Computational Brain Atlases and Finite-Element Methods for the Evaluation of MR-Based Atrophy Analysis Techniques in Dementia.***

O. Camara[1], M. Schweiger[1], R.I. Scahill[2], W.R. Crum[1], B.I. Sneller[1], J.A. Schnabel[1], G.R. Ridgway[1], D.M. Cash[1], N.C. Fox[2] and D.L.G. Hill

[1]Centre for Medical Image Computing, University College London, United Kingdom; [2]Dementia Research Centre, Institute of Neurology, University College London, United Kingdom.

2- ***Classification of Schizophrenic Patients With Resting Brain Functional Connectivity Using an Ensemble Classifier.***

M. Song[1], M. Liang[1], T. Jiang[1], Y. Zhou[1] and Z. Liu[2]

[1]National Laboratory of Pattern Recognition, Institute of Automation, Chinese Academy of Science, P.R. China; [2]Institute of Mental Health, Second Xiangya Hospital, Central South University, Changsha, Hunan, P.R. China.

15:10-15:30 Coffee break & Poster session: Applications

1- ***Towards Model-Based Localization of the Three Main Coronary Arteries in CT Images.***

B. Hofmann[1,3], J. Von Berg[1], C. Lorenz[1], O. Ecabert[2], J. Weese[2], J. Peters[2], A. Schilling[3] and F. Schick[3]

[1]Philips Research Laboratories, Röntgenstrasse Hamburg, Germany; [2]Philips Research Laboratories, Weisshausstrasse, Aachen, Germany; [3]Eberhard-Karls University, Tübingen, Germany.

2- ***Growth in the Developing Preterm Brain: A Comparison of Methods.***

P. Aljabar[1] , K.K. Bhatia[1] , M. Murgasova[1] , J.V. Hajnal[2] , J.P. Boardman[2], L. Srinivasan[2] , M.A. Rutherford[2], L.E. Dyet[3] , A.D. Edwards[2] and D. Rueckert[1]

[1]Visual Information Processing, Department of Computing, Imperial College London, United Kingdom; [2]Imaging Sciences Department, Imperial College London, United Kingdom; [3]Division of Clinical Sciences, Faculty of Medicine, Imperial College London, United Kingdom.

3- ***Brainstem Segmentation Protocol.***

S. Duchesne[1], M. Chakravarty[2], D.L. Collins[2] and C. Barillot[1]

[1]Equipe VISAGES, INRIA/INSERM, Rennes, France, [2]Montréal Neurological Institute (MNI), McGill Univ., Montréal, Canada.

4- ***Automatic Model-Based Neonatal Brain Segmentation from T1 MR Images.***

K. Kazemi [1,2], R. Grebe[1], H. A. Moghaddam [1,2], F. Wollois [1,3], and C. Gondry-Jouet [1,3]

[1]University of Picardie Jules Verne, France; [2]K. N. Toosi University of Technology, Tehran, Iran, [3]Centre Hospitalier Universitaire d'Amiens, Amiens, France.

5- ***Development of Histo-Anatomical Computer Models of the Heart.***

G. Plank[1], V. Grau[2], R.A.B. Burton[3], J.E . Schneider[4], A.J. Prassl[1] and P. Kohl[3]

[1]Institute of Biophysics, Medical University of Graz, Graz, Austria; [2]Dept. of Engineering Science, University of Oxford, Oxford, United Kingdom; [3]Dept. of Physiology, Anatomy and Genetics, University of Oxford, Oxford, United Kingdom; [4]Dept. of Cardiovascular Medicine, University of Oxford, Oxford, United Kingdom .

6- ***Estimation of Cardiac Electrical Propagation from Medical Image.***

H. Zhang[1], C.L. Wong[1], H. Liu and P. Shi[2,1]

[1]Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, China; [2]School of Biomedical Engineering, Southern Medical University, Guangzhou, China.

7- ***Personalized Airway Tree Models from Hyperpolarized Helium MRI Images of the Lung.***

W. Mullally[1], A. Milutinovic[2], M. Betke[1], M. Albert[3] and K. Lutchen[2]

[1]Department of Computer Science, Boston University, Boston, United States of America; [2]Department of Biomedical Engineering, Boston University, Boston, United States of America; [3]Hyperpolarized Noble Gas MRI Laboratory, Brigham and Women's Hospital, United States of America.

15:30-16:30: Statistical Atlases of Structure and Function III: Cardiology

1- ***A Whole Heart Mean Motion Model Built from Multi-Phase MSCT Data.***

C. Lorenz[1] and J. Von Berg[1]

[1]Philips Research Europe-Hamburg, Germany.

2- ***A Spatio-Temporal Deformation Model for Dense Motion Estimation in Periodic Cardiac Image Sequences.***

B. Delhay[1], P. Clarysse[1], C. Pera[1] and I. Magnin[1]

[1]Creatis, Inserm U, Lyon, France.

3- ***Fast and Automated Creation of Patient-Specific 3D Heart Model from Tagged MRI***

J. Schaerer[1], Z. Qian[2], P. Clarysse[1], D. Metaxas[2], L. Axel[3] and I. E. Magnin[1]

[1]Creatis, Inserm U, Lyon, France; [2]Department of Computer and Information Sciences, Rutgers University, Piscataway, New Jersey, United States of America [3]Department of Radiology, New York University, New York, New York, United States of America.

16:30-16:45: Adjourn