

Tianzi Jiang Nassir Navab  
Josien P.W. Pluim Max A. Viergever (Eds.)

# Medical Image Computing and Computer-Assisted Intervention – MICCAI 2010

13th International Conference  
Beijing, China, September 20-24, 2010  
Proceedings, Part III

## Volume Editors

Tianzi Jiang  
The Chinese Academy of Sciences, Institute of Automation  
Beijing 100080, P. R. China  
E-mail: jiangtz@nlpr.ia.ac.cn

Nassir Navab  
Technische Universität München, Institut für Informatik I16  
Boltzmannstr. 3, 85748 Garching, Germany  
E-mail: navab@cs.tum.edu

Josien P.W. Pluim  
Max A. Viergever  
University Medical Center Utrecht, QS.459  
Heidelberglaan 100, 3584 CX Utrecht, The Netherlands  
E-mail: j.pluim@umcutrecht.nl, max@isi.uu.nl

Library of Congress Control Number: 2010933822

CR Subject Classification (1998): I.4, I.5, I.2.10, I.3.5, J.3, I.6

LNCS Sublibrary: SL 6 – Image Processing, Computer Vision, Pattern Recognition,  
and Graphics

ISSN 0302-9743  
ISBN-10 3-642-15710-6 Springer Berlin Heidelberg New York  
ISBN-13 978-3-642-15710-3 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

springer.com

© Springer-Verlag Berlin Heidelberg 2010  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India  
Printed on acid-free paper 06/3180

# Preface

The 13th International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2010, was held in Beijing, China from 20-24 September, 2010. The venue was the China National Convention Center (CNCC), China's largest and newest conference center with excellent facilities and a prime location in the heart of the Olympic Green, adjacent to characteristic constructions like the Bird's Nest (National Stadium) and the Water Cube (National Aquatics Center).

MICCAI is the foremost international scientific event in the field of medical image computing and computer-assisted interventions. The annual conference has a high scientific standard by virtue of the threshold for acceptance, and accordingly MICCAI has built up a track record of attracting leading scientists, engineers and clinicians from a wide range of technical and biomedical disciplines.

This year, we received 786 submissions, well in line with the previous two conferences in New York and London. Three program chairs and a program committee of 31 scientists, all with a recognized standing in the field of the conference, were responsible for the selection of the papers. The review process was set up such that each paper was considered by the three program chairs, two program committee members, and a minimum of three external reviewers. The review process was double-blind, so the reviewers did not know the identity of the authors of the submission.

After a careful evaluation procedure, in which all controversial and gray area papers were discussed individually, we arrived at a total of 251 accepted papers for MICCAI 2010, of which 45 were selected for podium presentation and 206 for poster presentation. The acceptance percentage (32%) was in keeping with that of previous MICCAI conferences. All 251 papers are included in the three MICCAI 2010 LNCS volumes.

We are greatly indebted to the reviewers and to the members of the program committee for their invaluable efforts in critically assessing and evaluating the submissions in a very short time frame.

The annual MICCAI event has, in addition to its main conference, a rising number of satellite tutorials and workshops, organized on the day before and the day after the main conference. This year's call for submission for tutorials and workshops led to a record number of proposals, of which a significant fraction had to be rejected because of space and time limitations. The final program hosted eight tutorials, which together gave a comprehensive overview of many areas of the field, and provided rich educational material especially aimed at PhD students and postdoctoral researchers.

The 15 workshops gave - mostly younger - researchers the opportunity to present their work, often in an early stage of their investigations, so that they could obtain useful feedback from more experienced scientists in the field. The

workshop subjects highlighted topics that were not all fully covered in the main conference, and thus added to the diversity of the MICCAI program. In particular, several workshops offered so-called challenges in which researchers were in competition to best segment or register a set of clinical images with ground truth provided by medical experts. We are grateful to the tutorial and workshop committees, in particular to the chairs Dinggang Shen and Bram van Ginneken, for making these satellite events a success.

Highlights of the conference were the two keynote lectures. Professor Alan C. Evans of the McConnell Brain Imaging Centre, Montreal Neurological Institute, McGill University, Montreal, Canada described recent activity in brain network modeling with an emphasis on anatomical correlation analysis in his presentation “Network Analysis of Cortical Anatomy”. Professor Guang-Zhong Yang of the Royal Society/Wolfson Medical Image Computing Laboratory, Imperial College, London, UK outlined key clinical challenges and research opportunities in developing minimally invasive surgery systems in his presentation “Snake and Lobster - A Feast for MICCAI?”.

MICCAI 2010 would not have been feasible without the efforts of many people behind the scenes. We are particularly indebted to the local organizing committee in Beijing, consisting of Nianming Zuo, Yong Liu, Ming Song, Bing Liu, Bizhen Hong, Shaomei Wang, and Gangqin Zhang, all of the Institute of Automation of the Chinese Academy of Sciences, for their excellent work before and during the conference, and to Jacqueline Wermers for her outstanding assistance with the editorial work in compiling the three Springer LNCS books that contain the proceedings of this conference.

We are obliged to the Board of the MICCAI Society for the opportunity to organize this prestigious conference, and to many of the Society Board and Staff members for valuable and continuous advice and support through all phases of the preparation.

A special word of thanks goes to our sponsors, who generously provided financial support of the conference as a whole, or of specific activities. This greatly helped us with the overall organization of the meeting, as well as allowed us to award prizes for best papers in various categories and travel stipends to an appreciable number of student participants.

It was our great pleasure to welcome the attendees to Beijing for this exciting MICCAI 2010 conference and its satellite tutorials and workshops. The 14th International Conference on Medical Image Computing and Computer-Assisted Intervention will be held in Toronto, Canada, from 15-21 September 2011. We look forward to seeing you there.

September 2010

Tianzi Jiang  
Nassir Navab  
Josien Pluim  
Max Viergever

# Organization

## General Chair and Co-chairs

Tianzi Jiang	Institute of Automation, CAS, China
Alan Colchester	University of Kent, UK
James Duncan	Yale University, USA

## Program Chair and Co-chairs

Max Viergever	Utrecht University and UMC Utrecht, The Netherlands
Nassir Navab	Technische Universität München, Germany
Josien Pluim	University Medical Center Utrecht, The Netherlands

## Workshop Chair and Co-chairs

Bram van Ginneken	Radboud University Nijmegen, The Netherlands
Yong Fan	Institute of Automation, CAS, China
Polina Golland	Massachusetts Institute of Technology, USA
Tim Salcudean	University of British Columbia, Canada

## Tutorial Chair and Co-chairs

Dinggang Shen	University of North Carolina, USA
Alejandro Frangi	Universitat Pompeu Fabra, Spain
Gábor Székely	ETH Zürich, Switzerland

## MICCAI Society, Board of Directors

Nicholas Ayache	INRIA Sophia Antipolis, France
Kevin Cleary	Georgetown University, USA
James Duncan (President)	Yale University, USA
Gabor Fichtinger	Queen's University, Canada
Polina Golland	Massachusetts Institute of Technology, USA
Tianzi Jiang	Institute of Automation, CAS, China
Nassir Navab	Technische Universität München, Germany
Alison Noble	University of Oxford, UK
Sébastien Ourselin	University College London, UK
Ichiro Sakuma	University of Tokyo, Japan
Sandy Wells	Harvard Medical School, USA
Guang-Zhong Yang	Imperial College London, UK

## Program Committee

Christian Barillot	IRISA Rennes, France
Albert Chung	Hong Kong UST, China
Gabor Fichtinger	Queen's University, Canada
Alejandro Frangi	Universitat Pompeu Fabra, Spain
Jim Gee	University of Pennsylvania, USA
Bram van Ginneken	Radboud University Nijmegen, The Netherlands
Polina Golland	Massachusetts Institute of Technology, USA
David Hawkes	University College London, UK
Xiaoping Hu	Emory University, USA
Hongen Liao	University of Tokyo, Japan
Huafeng Liu	Zhejiang University, China
Cristian Lorenz	Philips Research Lab Hamburg, Germany
Frederik Maes	University of Leuven, Belgium
Anne Martel	University of Toronto, Canada
Kensaku Mori	Nagoya University, Japan
Mads Nielsen	University of Copenhagen, Denmark
Poul Nielsen	University of Auckland, New Zealand
Wiro Niessen	Erasmus MC Rotterdam, The Netherlands
Xiaochuan Pan	University of Chicago, USA
Franjo Pernuš	University of Ljubljana, Slovenia
Terry Peters	Robarts Research Institute, Canada
Daniel Rueckert	Imperial College London, UK
Tim Salcudean	University of British Columbia, Canada
Yoshinobu Sato	Osaka University, Japan
Dinggang Shen	University of North Carolina, USA
Pengcheng Shi	Rochester Institute of Technology, USA
Gábor Székely	ETH Zürich, Switzerland
Jocelyne Troccaz	TIMC-IMAG, Grenoble, France
Simon Warfield	Harvard University, USA
Carl-Fredrik Westin	Harvard University, USA
Guang-Zhong Yang	Imperial College London, UK

## Local Organizing Committee

Nianming Zuo	Institute of Automation,
Yong Liu	Chinese Academy of Sciences, China
Ming Song	
Bing Liu	
Bizhen Hong	
Shaomei Wang	
Gangqin Zhang	
Jacqueline Wermers	UMC Utrecht, The Netherlands

## Reviewers

Abolmaesumi, Purang  
Abugharbieh, Rafeef  
Acar, Burak  
Aja-Fernández, Santiago  
Akselrod-Ballin, Ayelet  
Alexander, Andrew  
Alexander, Daniel  
Aljabar, Paul  
Alomari, Raja  
Alvino, Christopher  
An, Jungha  
Angelini, Elsa  
Anor, Tomer  
Arbel, Tal  
Arridge, Simon  
Ashburner, John  
Astley, Sue  
Atkinson, David  
Audette, Michel  
Avants, Brian  
Awate, Suyash  
Babalola, Kolawole  
Bach Cuadra, Meritxell  
Baillet, Sylvain  
Banks, Scott  
Barratt, Dean  
Batchelor, Philip  
Baumann, Michael  
Bazin, Pierre-Louis  
Beckmann, Christian  
Beg, Mirza Faisal  
Beichel, Reinhard  
Berger, Marie-Odile  
Bergtholdt, Martin  
Berman, Jeffrey  
Betke, Margrit  
Bhalerao, Abhir  
Bhotika, Rahul  
Bian, Junguo  
Birkfellner, Wolfgang  
Birn, Rasmus  
Bischof, Horst  
Boctor, Emad  
Boisvert, Jonathan  
Bosch, Johan  
Bouix, Sylvain  
Boukerroui, Djamel  
Bourgeat, Pierrick  
Brady, Mike  
Bricault, Ivan  
Brun, Caroline  
Buelow, Thomas  
Bullitt, Elizabeth  
Burschka, Darius  
Butakoff, Constantine  
Cahill, Nathan  
Cai, Yiyu  
Camara, Oscar  
Cardenes, Ruben  
Cates, Joshua  
Cattin, Philippe  
Chakravarty, Mallar  
Chen, Elvis  
Chen, Sheng  
Chen, Wei  
Chen, Yunmei  
Chen, Zhiqiang  
Cheriet, Farida  
Chinzei, Kiyoyuki  
Chou, Yiyu  
Christensen, Gary  
Chung, Moo  
Cinquin, Philippe  
Ciuciu, Philippe  
Claridge, Ela  
Clarysse, Patrick  
Cleary, Kevin  
Clerc, Maureen  
Colchester, Alan  
Collins, Louis  
Colliot, Olivier  
Comaniciu, Dorin  
Commowick, Olivier  
Cook, Philip  
Cootes, Tim  
Cotin, Stéphane  
Coulon, Olivier  
Coupé, Pierrick

Craddock, Cameron	Fischer, Bernd
Crozier, Stuart	Fitzpatrick, Michael
Crum, William	Fleig, Oliver
Darkner, Sune	Florack, Luc
Dauguet, Julien	Fouard, Celine
Dawant, Benoit	Freysinger, Wolfgang
De Bruijne, Marleen	Fuernstahl, Philipp
De Buck, Stijn	Funka-Lea, Gareth
De Craene, Mathieu	Gan, Rui
Deguchi, Daisuke	Ganz, Melanie
Dehghan, Ehsan	Gao, Fei
Deligianni, Fani	Gee, Andrew
Demirci, Stefanie	Gerig, Guido
Deriche, Rachid	Gessat, Michael
Descoteaux, Maxime	Gholipour, Ali
Desphande, Gopikrishna	Gibaud, Bernard
Desvignes, Michel	Gladilin, Evgeny
Dey, Joyoni	Glocker, Ben
Dijkstra, Jouke	Goksel, Orcun
DiMaio, Simon	Gonzalez Ballester, Miguel Angel
Doignon, Christophe	Gooding, Mark
Douiri, Abdel	Goodlett, Casey
Drangova, Maria	Gooya, Ali
Du, Yiping	Gorbunova, Vladlena
Duan, Qi	Grady, Leo
Duchesne, Simon	Graham, Jim
Duncan, James	Grau, Vicente
Dupont, Pierre	Groher, Martin
Ebrahimi, Mehran	Gu, Lixu
Ecabert, Olivier	Guehring, Jens
Eggers, Georg	Guetter, Christoph
Ehrhardt, Jan	Haake, Anne
El-Baz, Ayman	Hager, Gregory
Ellis, Randy	Hahn, Horst
Enescu, Monica	Hamarneh, Ghassan
Fabry, Thomas	Han, Xiao
Fahrig, Rebecca	Hanson, Dennis
Fan, Yong	Harders, Matthias
Farag, Aly	Hastreiter, Peter
Fenster, Aaron	Hata, Nobuhiko
Feragen, Aasa	Haynor, David
Ferrari, Ricardo	He, Yong
Feuerstein, Marco	Heimann, Tobias
Figl, Michael	Hellier, Pierre
Fillard, Pierre	Heng, Pheng Ann



Hermosillo, Gerardo  
Higgins, William  
Hipwell, John  
Ho, Hon Pong  
Hoffmann, Kenneth  
Hogeweg, Laurens  
Holmes, David  
Holz, Dirk  
Hoogendoorn, Corn e  
Hornegger, Joachim  
Howe, Robert  
Hu, Mingxing  
Hu, Zhenghui  
Huang, Heng  
Huang, Qi-xing  
Huang, Xiaolei  
Huo, Xiaoming  
Hyde, Damon  
Ingalhalikar, Madhura  
Isgum, Ivana  
Jain, Ameet  
Janke, Andrew  
Jannin, Pierre  
Jin, Mingwu  
Jomier, Julien  
Joshi, Anand  
Joshi, Sarang  
Kabus, Sven  
Kadah, Yasser  
Kadir, Timor  
Kadoury, Samuel  
Kamen, Ali  
Kang, Dong-Goo  
Karemore, Gopal  
Karssemeijer, Nico  
Kaus, Michael  
Kazanzides, Peter  
Keeve, Erwin  
Kerrien, Erwan  
Kervrann, Charles  
Kikinis, Ron  
Kim, Boklye  
Kindlmann, Gordon  
King, Andrew  
Kirchberg, Klaus  
Kitasaka, Takayuki  
Klein, Arno  
Klein, Stefan  
Klinder, Tobias  
Kontos, Despina  
Krissian, Karl  
Kruggel, Frithjof  
Kutter, Oliver  
Kybic, Jan  
Lai, Shang-Hong  
Laine, Andrew  
Landman, Bennett  
Langs, Georg  
Larrabide, Ignacio  
Larsen, Rasmus  
Lassen, Bianca  
Law, Max  
Lazar, Mariana  
Lee, Junghoon  
Leemans, Alexander  
Lei, Hao  
Lekadir, Karim  
Lelieveldt, Boudewijn  
Leow, Alex  
Lepore, Natasha  
Lerch, Jason  
Lesage, David  
Li, Chunming  
Li, Ming  
Li, Quanzheng  
Li, Shuo  
Liang, Jianming  
Liao, Rui  
Liao, Shu  
Likar, Boštjan  
Lin, Xiang  
Lindseth, Frank  
Linguraru, Marius George  
Linte, Cristian  
Litt, Harold  
Liu, Alan  
Liu, Tianming  
Liu, Yong  
Lo, Pechin  
Loeckx, Dirk

Loew, Murray  
 Lu, Le  
 Luan, Kuan  
 Luboz, Vincent  
 Luo, Yishan  
 Ma, Burton  
 Madabhushi, Anant  
 Maeder, Anthony  
 Magee, Derek  
 Maier-Hein, Lena  
 Mainprize, James  
 Malandain, Gregoire  
 Manduca, Armando  
 Mangin, Jean-François  
 Mao, Hongda  
 Mao, Hui  
 Markelj, Primož  
 Martí, Robert  
 Martin-Fernandez, Marcos  
 Masamune, Ken  
 Masutani, Yoshitaka  
 Mazza, Edoardo  
 McClelland, Jamie  
 McCulloch, Andrew  
 McGregor, Robert  
 Metaxas, Dimitris  
 Metz, Coert  
 Meyer, Chuck  
 Miller, James  
 Milles, Julien  
 Mohamed, Ashraf  
 Moireau, Philippe  
 Mollemans, Wouter  
 Mungwe, Stanley  
 Murgasova, Maria  
 Murphy, Keelin  
 Mylonas, George  
 Naish, Michael  
 Nakamoto, Masahiko  
 Nash, Martyn  
 Nedjati-Gilani, Shahrum  
 Nichols, Thomas  
 Nicolau, Stephane  
 Niemeijer, Meindert  
 Niethammer, Marc

Nimura, Yukitaka  
 Noble, Alison  
 Noël, Peter  
 Nolte, Lutz  
 Noonan, David  
 Oda, Masahiro  
 O'Donnell, Lauren  
 O'Donnell, Thomas  
 Ogier, Arnaud  
 Oguz, Ipek  
 Olabariaga, Silvia  
 Olmos, Salvador  
 Olszewski, Mark  
 Orkisz, Maciej  
 Otake, Yoshito  
 Ourselin, Sébastien  
 Ozarslan, Evren  
 Pang, Wai-Man  
 Pantazis, Dimitrios  
 Papadopoulo, Théo  
 Paragios, Nikos  
 Pasternak, Ofer  
 Patriciu, Alexandru  
 Pavani, Sri Kaushik  
 Payan, Yohan  
 Peitgen, Heinz-Otto  
 Penneç, Xavier  
 Penney, Graeme  
 Petersen, Kersten  
 Petr, Jan  
 Peyrat, Jean-Marc  
 Pham, Dzung  
 Pichon, Eric  
 Pike, Bruce  
 Pitiot, Alain  
 Pizarro, Luis  
 Pohl, Kilian Maria  
 Poignet, Philippe  
 Prager, Richard  
 Prastawa, Marcel  
 Prause, Guido  
 Prima, Sylvain  
 Prince, Jerry  
 Promayon, Emmanuel  
 Qi, Jinyi

Qian, Xiaoning  
 Radeva, Petia  
 Rajagopal, Vijayaraghavan  
 Rajpoot, Nasir  
 Rangarajan, Anand  
 Rasche, Volker  
 Reichl, Tobias  
 Reinhardt, Joseph  
 Rexilius, Jan  
 Reyes, Mauricio  
 Rhode, Kawal  
 Ribbens, Annemie  
 Ridgway, Gerard  
 Rittscher, Jens  
 Rivaz, Hassan  
 Riviere, Cameron  
 Robb, Richard  
 Robinson, Emma  
 Rohlfing, Torsten  
 Rohling, Robert  
 Rohr, Karl  
 Rougon, Nicolas  
 Rousseau, François  
 Russakoff, Daniel  
 Sabuncu, Mert Rory  
 Sachse, Frank  
 Sakuma, Ichiro  
 Salvado, Olivier  
 Samani, Abbas  
 Sanchez, Clara  
 Savadjiev, Peter  
 Schaap, Michiel  
 Scherrer, Benoit  
 Schnabel, Julia  
 Schweikard, Achim  
 Sebastian, Rafa  
 Sermesant, Maxime  
 Shams, Ramtin  
 Shechter, Guy  
 Shi, Yonggang  
 Shi, Yundi  
 Shimizu, Akinobu  
 Siddiqi, Kaleem  
 Sidky, Emil  
 Siewerdsen, Jeffrey  
 Simaan, Nabil  
 Skrinjar, Oskar  
 Slagmolen, Pieter  
 Sled, John  
 Smal, Ihor  
 Smeets, Dirk  
 Smelyanskiy, Mikhail  
 So, Wai King  
 Sommer, Stefan  
 Song, Xubo  
 Sonka, Milan  
 Sørensen, Lauge  
 Spillmann, Jonas  
 Sporring, Jon  
 Staal, Joes  
 Staib, Lawrence  
 Staring, Marius  
 Stewart, James  
 Stoyanov, Danaïl  
 Studholme, Colin  
 Styner, Martin  
 Suarez, Ralph  
 Subramanian, Navneeth  
 Sukno, Federico  
 Summers, Ronald  
 Suzuki, Kenji  
 Szczerba, Dominik  
 Szilagyi, Laszlo  
 Tanner, Christine  
 Tao, Xiaodong  
 Tasdizen, Tolga  
 Taylor, Chris  
 Taylor, Russell  
 Taylor, Zeike  
 Tek, Huseyin  
 Ter Haar Romeny, Bart  
 Thévenaz, Philippe  
 Thiran, Jean-Philippe  
 Thiriet, Marc  
 Thirion, Bertrand  
 Todd Pokropek, Andrew  
 Toews, Matthew  
 Tomaževič, Dejan  
 Tosun, Duygu  
 Tristán-Vega, Antonio

Tsechpenakis, Gavriil  
Tustison, Nicholas  
Tutar, Ismail  
Twining, Carole  
Unal, Gozde  
Vaillant, Regis  
Van Leemput, Koen  
Van Rikxoort, Eva  
Van Stralen, Marijn  
Van Walsum, Theo  
Vannier, Michael  
Vemuri, Baba  
Venkataraman, Archana  
Vercauteren, Tom  
Verma, Ragini  
Vidal, Pierre Paul  
Vik, Torbjörn  
Vilanova, Anna  
Villard, Pierre-Frederic  
Von Berg, Jens  
Voros, Sandrine  
Vos, Frans  
Vosburgh, Kirby  
Vrooman, Henri  
Vrtovec, Tomaz  
Wachinger, Christian  
Wang, Defeng  
Wang, Fei  
Wang, Junchen  
Wang, Linwei  
Wang, Yalin  
Wang, Yongmei Michelle  
Ward, Aaron  
Watton, Paul  
Weber, Stefan  
Weese, Jürgen  
Wein, Wolfgang  
Weisenfeld, Neil  
Wells, William  
West, Jay  
Whitaker, Ross

Wiemker, Rafael  
Wimmer, Andreas  
Wolf, Ivo  
Wolz, Robin  
Wong, Ken  
Woolrich, Mark  
Wu, Ed  
Wu, Guorong  
Wu, John Jue  
Xia, Dan  
Xu, Jianwu  
Xu, Qianyi  
Xue, Zhong  
Yan, Pingkun  
Yang, Hua  
Yap, Pew-Thian  
Yeo, Thomas  
Yezzi, Anthony  
Yoo, Terry  
Yoshida, Hiro  
Young, Alistair  
Yu, Weichuan  
Yushkevich, Paul  
Zang, Yufeng  
Zhang, Heye  
Zhang, Hui  
Zhang, Yong  
Zhao, Fuqiang  
Zheng, Bo  
Zheng, Guoyan  
Zheng, Yefeng  
Zhou, Luping  
Zhou, Kevin  
Zhou, Xiang  
Zhou, Yu  
Zhu, Hongtu  
Zhu, Yun  
Zikic, Darko  
Zöllei, Lilla  
Zuo, Nianming  
Zwiggelaar, Reyer

## Awards Presented at the 12th International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2009, London

### *MICCAI Society Enduring Impact Award*

The Enduring Impact Award is the highest award of the Medical Image Computing and Computer-Assisted Intervention Society. It is a career award for continued excellence in the MICCAI research field. The 2009 Enduring Impact Award was presented to **Ron Kikinis**, Harvard Medical School, USA.

### *MICCAI Society Fellowships*

MICCAI Fellowships are bestowed annually on a small number of senior members of the Society in recognition of substantial scientific contributions to the MICCAI research field and service to the MICCAI community. The first fellowships were presented in 2009, to

**Nicholas Ayache** (INRIA Sophia-Antipolis, France)

**Alan Colchester** (University of Kent, UK)

**Takeyoshi Dohi** (University of Tokyo, Japan)

**Guido Gerig** (University of Utah, USA)

**David Hawkes** (University College London, UK)

**Karl Heinz Höhne** (University of Hamburg, Germany)

**Ron Kikinis** (Harvard Medical School, USA)

**Terry Peters** (Robarts Research Institute, Canada)

**Richard Robb** (Mayo Clinic, USA)

**Chris Taylor** (University of Manchester, UK)

**Russ Taylor** (Johns Hopkins University, USA)

**Max Viergever** (University Medical Center Utrecht, The Netherlands).

### *MedIA-MICCAI Prize*

The 2009 MedIA-MICCAI Prize for the best paper in the special MICCAI issue of Medical Image Analysis, sponsored by Elsevier, was awarded to

**Vicky Wang** (University of Auckland, New Zealand)

for the article “Modelling passive diastolic mechanics with quantitative MRI of cardiac structure and function”, authored by Vicky Y. Wang, Hoi I. Lam, Daniel B. Ennis, Brett R. Cowan, Alistair A. Young, and Martyn P. Nash.

### *Best Paper in Navigation*

The prize for the best paper in the MICCAI 2009 conference in the area of navigation, sponsored by Medtronic, was awarded to

**Wolfgang Wein** (Siemens Corporate Research, Princeton, USA)

for the article: “Towards guidance of electrophysiological procedures with real-time 3D intracardiac echocardiography fusion to C-arm CT”, authored by Wolfgang Wein, Estelle Camus, Matthias John, Mamadou Diallo, Christophe Duong, Amin Al-Ahmad, Rebecca Fahrig, Ali Khamene, and Chenyang Xu.

*Best Paper in Computer-Assisted Intervention Systems and Medical Robotics*

The prize for the best paper in the MICCAI 2009 conference in the area of computer-assisted intervention systems and medical robotics, sponsored by Intuitive Surgical, was awarded to

**Marcin Balicki** (Johns Hopkins University, USA)

for the article “Single fiber optical coherence tomography microsurgical instruments for computer and robot-assisted retinal surgery”, authored by Marcin Balicki, Jae-Ho Han, Iulian Iordachita, Peter Gehlbach, James Handa, Russell Taylor, Jin Kang.

*MICCAI Young Scientist Awards*

The Young Scientist Awards are stimulation prizes awarded to the best first authors of MICCAI contributions in distinct subject areas. The nominees had to be a full-time student at a recognized university at - or within the two years before - the time of submission. The 2009 MICCAI Young Scientist Awards were presented to

**Tammy Riklin Raviv** (MIT, USA), for the article “Joint segmentation of image ensembles via latent atlases”

**Christopher Rohkohl** (Friedrich-Alexander University, Germany), for the article “Interventional 4-D motion estimation and reconstruction of cardiac vasculature without motion”

**Peter Savadjiev** (Harvard Medical School, USA), for the article “Local white matter geometry indices from diffusion tensor gradients”

**Lejing Wang** (TU Munich, Germany), for the article “Parallax-free long bone X-ray image stitching”

**Yiyi Wei** (INRIA Lille, France; LIAMA CASIA, China), for the article “Toward real-time simulation of blood-coil interaction during aneurysm embolization”.

# Table of Contents – Part III

## Segmentation and Modeling

Combining Morphological Information in a Manifold Learning Framework: Application to Neonatal MRI . . . . .	1
<i>P. Aljabar, R. Wolz, L. Srinivasan, S. Counsell, J.P. Boardman, M. Murgasova, V. Doria, M.A. Rutherford, A.D. Edwards, J.V. Hajnal, and D. Rueckert</i>	
Fast Random Walker with Priors Using Precomputation for Interactive Medical Image Segmentation . . . . .	9
<i>Shawn Andrews, Ghassan Hamarneh, and Ahmed Saad</i>	
Extraction of the Plane of Minimal Cross-Sectional Area of the Corpus Callosum Using Template-Driven Segmentation . . . . .	17
<i>Neda Changizi, Ghassan Hamarneh, Omer Ishaq, Aaron Ward, and Roger Tam</i>	
Incorporating Priors on Expert Performance Parameters for Segmentation Validation and Label Fusion: A Maximum a Posteriori STAPLE . . . . .	25
<i>Olivier Commowick and Simon K. Warfield</i>	
Automated Segmentation of 3-D Spectral OCT Retinal Blood Vessels by Neural Canal Opening False Positive Suppression . . . . .	33
<i>Zhihong Hu, Meindert Niemeijer, Michael D. Abramoff, Kyungmoo Lee, and Mona K. Garvin</i>	
Detection of Gad-Enhancing Lesions in Multiple Sclerosis Using Conditional Random Fields . . . . .	41
<i>Zahra Karimaghloo, Mohak Shah, Simon J. Francis, Douglas L. Arnold, D. Louis Collins, and Tal Arbel</i>	
Automated Sulci Identification via Intrinsic Modeling of Cortical Anatomy . . . . .	49
<i>Yonggang Shi, Bo Sun, Rongjie Lai, Ivo Dinov, and Arthur W. Toga</i>	
In Vivo MRI Assessment of Knee Cartilage in the Medial Meniscal Tear Model of Osteoarthritis in Rats . . . . .	57
<i>Zhiyong Xie, Serguei Liachenko, Ping-Chun Chiao, Santos Carvajal-Gonzalez, Susan Bove, and Thomas Bocan</i>	

Construction of Neuroanatomical Shape Complex Atlas from 3D Brain MRI .....	65
<i>Ting Chen, Anand Rangarajan, Stephan J. Eisenschenk, and Baba C. Vemuri</i>	
Non-parametric Iterative Model Constraint Graph Min-Cut for Automatic Kidney Segmentation .....	73
<i>M. Freiman, A. Kronman, S.J. Esses, L. Joskowicz, and J. Sosna</i>	
Synthetic MRI Signal Standardization: Application to Multi-atlas Analysis .....	81
<i>Juan Eugenio Iglesias, Ivo Dinov, Jaskaran Singh, Gregory Tong, and Zhuowen Tu</i>	
Multi-organ Segmentation from Multi-phase Abdominal CT via 4D Graphs Using Enhancement, Shape and Location Optimization .....	89
<i>Marius George Linguraru, John A. Pura, Ananda S. Chowdhury, and Ronald M. Summers</i>	
A Semi-automatic Method for Segmentation of the Carotid Bifurcation and Bifurcation Angle Quantification on Black Blood MRA .....	97
<i>Hui Tang, Robbert S. van Onkelen, Theo van Walsum, Reinhard Hameeteman, Michiel Schaap, Fufa. L. Tori, Quirijn J.A. van den Bouwhuijsen, Jacqueline C.M. Witteman, Aad van der Lugt, Lucas J. van Vliet, and Wiro J. Niessen</i>	
<i>Standing on the Shoulders of Giants: Improving Medical Image Segmentation via Bias Correction .....</i>	105
<i>Hongzhi Wang, Sandhitsu Das, John Pluta, Caryne Craige, Murat Altinay, Brian Avants, Michael Weiner, Susanne Mueller, and Paul Yushkevich</i>	
Layout Consistent Segmentation of 3-D Meshes via Conditional Random Fields and Spatial Ordering Constraints .....	113
<i>Alexander Zouhar, Sajjad Baloch, Yanghai Tsin, Tong Fang, and Siegfried Fuchs</i>	
Cross-Visit Tumor Sub-segmentation and Registration with Outlier Rejection for Dynamic Contrast-Enhanced MRI Time Series Data .....	121
<i>G.A. Buonaccorsi, C.J. Rose, J.P.B. O'Connor, C. Roberts, Y. Watson, A. Jackson, G.C. Jayson, and G.J.M. Parker</i>	
Nonlocal Patch-Based Label Fusion for Hippocampus Segmentation .....	129
<i>Pierrick Coupé, José V. Manjón, Vladimir Fonov, Jens Pruessner, Montserrat Robles, and D. Louis Collins</i>	
Cellular Automata Segmentation of Brain Tumors on Post Contrast MR Images .....	137
<i>Andac Hamamci, Gozde Unal, Nadir Kucuk, and Kayihan Engin</i>	



Agreement-Based Semi-supervised Learning for Skull Stripping . . . . .	147
<i>Juan Eugenio Iglesias, Cheng-Yi Liu, Paul Thompson, and Zhuowen Tu</i>	
Construction of Patient Specific Atlases from Locally Most Similar Anatomical Pieces . . . . .	155
<i>Liliane Ramus, Olivier Commowick, and Grégoire Malandain</i>	
Automatic Lung Lobe Segmentation Using Particles, Thin Plate Splines, and Maximum a Posteriori Estimation . . . . .	163
<i>James C. Ross, Raúl San José Estépar, Gordon Kindlmann, Alejandro Díaz, Carl-Fredrik Westin, Edwin K. Silverman, and George R. Washko</i>	
Graph Search with Appearance and Shape Information for 3-D Prostate and Bladder Segmentation . . . . .	172
<i>Qi Song, Yinxiao Liu, Yunlong Liu, Punam K. Saha, Milan Sonka, and Xiaodong Wu</i>	
Segmentation of Cortical MS Lesions on MRI Using Automated Lamina Profile Shape Analysis . . . . .	181
<i>Christine L. Tardif, D. Louis Collins, Simon F. Eskildsen, John B. Richardson, and G. Bruce Pike</i>	
3D Knowledge-Based Segmentation Using Pose-Invariant Higher-Order Graphs . . . . .	189
<i>Chaohui Wang, Olivier Teboul, Fabrice Michel, Salma Essafi, and Nikos Paragios</i>	
Markov Random Field Driven Region-Based Active Contour Model (MaRACel): Application to Medical Image Segmentation . . . . .	197
<i>Jun Xu, James P. Monaco, and Anant Madabhushi</i>	
<b>Robotics, Motion Modeling and Computer-Assisted Interventions</b>	
Predicting Target Vessel Location for Improved Planning of Robot-Assisted CABG Procedures . . . . .	205
<i>Daniel S. Cho, Cristian A. Linte, Elvis Chen, Chris Wedlake, John Moore, John Barron, Rajni Patel, and Terry M. Peters</i>	
Quantification of Prostate Deformation due to Needle Insertion during TRUS-guided Biopsy . . . . .	213
<i>Tharindu De Silva, Aaron Fenster, Jagath Samarabandu, and Aaron D. Ward</i>	
Optimized Anisotropic Rotational Invariant Diffusion Scheme on Cone-Beam CT . . . . .	221
<i>Dirk-Jan Kroon, Cornelis H. Slump, and Thomas J.J. Maal</i>	

Control of Articulated Snake Robot under Dynamic Active Constraints . . . . .	229
<i>Ka-Wai Kwok, Valentina Vitiello, and Guang-Zhong Yang</i>	
Estimating Radiation Exposure in Interventional Environments . . . . .	237
<i>Alexander Ladikos, Cedric Cagniard, Reza Ghotbi, Maximilian Reiser, and Nassir Navab</i>	
Force Adaptive Multi-spectral Imaging with an Articulated Robotic Endoscope . . . . .	245
<i>David P. Noonan, Christopher J. Payne, Jianzhong Shang, Vincent Sauvage, Richard Newton, Daniel Elson, Ara Darzi, and Guang-Zhong Yang</i>	
Motion Tracking in Narrow Spaces: A Structured Light Approach . . . . .	253
<i>Oline Vinter Olesen, Rasmus R. Paulsen, Liselotte Højgaard, Bjarne Roed, and Rasmus Larsen</i>	
Tracking of Irregular Graphical Structures for Tissue Deformation Recovery in Minimally Invasive Surgery . . . . .	261
<i>Marco Visentini-Scarzanella, Robert Merrifield, Danail Stoyanov, and Guang-Zhong Yang</i>	
Graph Based Interactive Detection of Curve Structures in 2D Fluoroscopy . . . . .	269
<i>Peng Wang, Wei-shing Liao, Terrence Chen, Shaohua K. Zhou, and Dorin Comaniciu</i>	
Automated Digital Dental Articulation . . . . .	278
<i>James J. Xia, Yu-Bing Chang, Jaime Gateno, Zixiang Xiong, and Xiaobo Zhou</i>	
Image-Based Respiratory Motion Compensation for Fluoroscopic Coronary Roadmapping . . . . .	287
<i>Ying Zhu, Yanghai Tsing, Hari Sundar, and Frank Sauer</i>	
Surgical Task and Skill Classification from Eye Tracking and Tool Motion in Minimally Invasive Surgery . . . . .	295
<i>Narges Ahmadi, Gregory D. Hager, Lisa Ishii, Gabor Fichtinger, Gary L. Gallia, and Masaru Ishii</i>	
Micro-force Sensing in Robot Assisted Membrane Peeling for Vitreoretinal Surgery . . . . .	303
<i>Marcin Balicki, Ali Uneri, Iulian Iordachita, James Handa, Peter Gehlbach, and Russell Taylor</i>	
C-arm Pose Estimation in Prostate Brachytherapy by Registration to Ultrasound . . . . .	311
<i>Pascal Fallavollita, Clif Burdette, Danny Song, Purang Abolmaesumi, and Gabor Fichtinger</i>	

Cognitive Burden Estimation for Visuomotor Learning with fNIRS . . . . . <i>David R.C. James, Felipe Orihuela-Espina, Daniel R. Leff, George P. Mylonas, Ka-Wai Kwok, Ara W. Darzi, and Guang-Zhong Yang</i>	319
Prediction Framework for Statistical Respiratory Motion Modeling . . . . . <i>Tobias Klinder, Cristian Lorenz, and Jörn Ostermann</i>	327
Image Estimation from Marker Locations for Dose Calculation in Prostate Radiation Therapy . . . . . <i>Huai-Ping Lee, Mark Foskey, Josh Levy, Rohit Saboo, and Ed Chaney</i>	335
A Machine Learning Approach for Deformable Guide-Wire Tracking in Fluoroscopic Sequences . . . . . <i>Olivier Pauly, Hauke Heibel, and Nassir Navab</i>	343
Collaborative Tracking for MRI-Guided Robotic Intervention on the Beating Heart . . . . . <i>Y. Zhou, E. Yeniaras, P. Tsiamyrtzis, N. Tsekos, and I. Pavlidis</i>	351
Calibration and Use of Intraoperative Cone-Beam Computed Tomography: An In-Vitro Study for Wrist Fracture . . . . . <i>Erin Janine Smith, Anton Oentoro, Hisham Al-Sanawi, Braden Gammon, Paul St. John, David R. Pichora, and Randy E. Ellis</i>	359
A Strain Energy Filter for 3D Vessel Enhancement . . . . . <i>Changyan Xiao, Marius Staring, Denis Shamonin, Johan H.C. Reiber, Jan Stolk, and Berend C. Stoel</i>	367
Virtual Stent Grafting in Personalized Surgical Planning for Treatment of Aortic Aneurysms Using Image-Based Computational Fluid Dynamics . . . . . <i>Guanglei Xiong and Charles A. Taylor</i>	375
MRI-Guided Robotic Prostate Biopsy: A Clinical Accuracy Validation . . . . . <i>Helen Xu, Andras Lasso, Siddharth Vikal, Peter Guion, Azel Krieger, Aradhana Kaushal, Louis L. Whitcomb, and Gabor Fichtinger</i>	383
Online 4-D CT Estimation for Patient-Specific Respiratory Motion Based on Real-Time Breathing Signals . . . . . <i>Tiancheng He, Zhong Xue, Weixin Xie, and Stephen T.C. Wong</i>	392
Modeling and Segmentation of Surgical Workflow from Laparoscopic Video . . . . . <i>Tobias Blum, Hubertus Feußner, and Nassir Navab</i>	400

Fused Video and Ultrasound Images for Minimally Invasive Partial Nephrectomy: A Phantom Study . . . . .	408
<i>Carling L. Cheung, Chris Wedlake, John Moore, Stephen E. Pautler, and Terry M. Peters</i>	
Probabilistic 4D Blood Flow Mapping . . . . .	416
<i>Ola Friman, Anja Hennemuth, Andreas Harloff, Jelena Bock, Michael Markl, and Heinz-Otto Peitgen</i>	
Rotational Encoding of C-arm Fluoroscope with Tilt Sensing Accelerometer . . . . .	424
<i>Victor Grzeda and Gabor Fichtinger</i>	
Robotic Hand-Held Surgical Device: Evaluation of End-Effector's Kinematics and Development of Proof-of-Concept Prototypes . . . . .	432
<i>Ali Hassan Zahraee, Jérôme Szewczyk, Jamie Kyujin Paik, and Guillaume Morel</i>	
Guide-Wire Extraction through Perceptual Organization of Local Segments in Fluoroscopic Images . . . . .	440
<i>Nicolas Honnorat, Régis Vaillant, and Nikos Paragios</i>	
Single-Projection Based Volumetric Image Reconstruction and 3D Tumor Localization in Real Time for Lung Cancer Radiotherapy . . . . .	449
<i>Ruijiang Li, Xun Jia, John H. Lewis, Xuejun Gu, Michael Folkerts, Chunhua Men, and Steve B. Jiang</i>	
A Method for Planning Safe Trajectories in Image-Guided Keyhole Neurosurgery . . . . .	457
<i>Reuben R. Shamir, Idit Tamir, Elad Dabool, Leo Joskowicz, and Yigal Shoshan</i>	
Adaptive Multispectral Illumination for Retinal Microsurgery . . . . .	465
<i>Raphael Sznitman, Diego Rother, Jim Handa, Peter Gehlbach, Gregory D. Hager, and Russell Taylor</i>	
Motion Artifact Correction of Multi-Photon Imaging of Awake Mice Models Using Speed Embedded HMM . . . . .	473
<i>Taoyi Chen, Zhong Xue, Changhong Wang, Zhenshen Qu, Kelvin K. Wong, and Stephen T.C. Wong</i>	
<b>Image Reconstruction, Enhancement and Representation</b>	
Diagnostic Radiograph Based 3D Bone Reconstruction Framework: Application to Osteotomy Surgical Planning . . . . .	481
<i>Pavan Gamage, Sheng Quan Xie, Patrice Delmas, and Wei Liang Xu</i>	

Comparative Analysis of Quasi-Conformal Deformations in Shape Space .....	489
<i>Vahid Taimouri, Huiquan He, and Jing Hua</i>	
Establishing Spatial Correspondence between the Inner Colon Surfaces from Prone and Supine CT Colonography .....	497
<i>Holger Roth, Jamie McClelland, Marc Modat, Darren Boone, Mingxing Hu, Sebastien Ourselin, Greg Slabaugh, Steve Halligan, and David Hawkes</i>	
Heat Kernel Smoothing Using Laplace-Beltrami Eigenfunctions .....	505
<i>Seongho Seo, Moo K. Chung, and Hourri K. Vorperian</i>	
Under-Determined Non-cartesian MR Reconstruction with Non-convex Sparsity Promoting Analysis Prior .....	513
<i>Angshul Majumdar and Rabab K. Ward</i>	
A Statistical Approach for Achievable Dose Querying in IMRT Planning .....	521
<i>Patricio Simari, Binbin Wu, Robert Jacques, Alex King, Todd McNutt, Russell Taylor, and Michael Kazhdan</i>	
Multivariate Statistical Analysis of Deformation Momenta Relating Anatomical Shape to Neuropsychological Measures .....	529
<i>Nikhil Singh, P. Thomas Fletcher, J. Samuel Preston, Linh Ha, Richard King, J. Stephen Marron, Michael Wiener, and Sarang Joshi</i>	
Shape Analysis of Vestibular Systems in Adolescent Idiopathic Scoliosis Using Geodesic Spectra .....	538
<i>Wei Zeng, Lok Ming Lui, Lin Shi, Defeng Wang, Winnie C.W. Chu, Jack C.Y. Cheng, Jing Hua, Shing-Tung Yau, and Xianfeng Gu</i>	
Value-Based Noise Reduction for Low-Dose Dual-Energy Computed Tomography .....	547
<i>Michael Balda, Björn Heismann, and Joachim Hornegger</i>	
Automatic Detection of Anatomical Features on 3D Ear Impressions for Canonical Representation .....	555
<i>Sajjad Baloch, Rupen Melkisetoglu, Simon Flöry, Sergei Azernikov, Greg Slabaugh, Alexander Zouhar, and Tong Fang</i>	
Probabilistic Multi-Shape Representation Using an Isometric Log-Ratio Mapping .....	563
<i>Neda Changizi and Ghassan Hamarneh</i>	
Efficient Robust Reconstruction of Dynamic PET Activity Maps with Radioisotope Decay Constraints .....	571
<i>Fei Gao, Huafeng Liu, and Pengcheng Shi</i>	

Nonlinear Embedding towards Articulated Spine Shape Inference Using Higher-Order MRFs ..... 579  
*Samuel Kadoury and Nikos Paragios*

Improved Method for Point-Based Tracking ..... 587  
*Andrei Danilchenko, Andrew D. Wiles, Ramya Balachandran, and J. Michael Fitzpatrick*

**Computer Aided Diagnosis**

A Texton-Based Approach for the Classification of Lung Parenchyma in CT Images ..... 595  
*Mehrdad J. Gangeh, Lauge Sørensen, Saher B. Shaker, Mohamed S. Kamel, Marleen de Bruijne, and Marco Loog*

Active Learning for an Efficient Training Strategy of Computer-Aided Diagnosis Systems: Application to Diabetic Retinopathy Screening ..... 603  
*C.I. Sánchez, M. Niemeijer, M.D. Abràmoff, and B. van Ginneken*

Sparse Bayesian Learning for Identifying Imaging Biomarkers in AD Prediction ..... 611  
*Li Shen, Yuan Qi, Sungeun Kim, Kwangsik Nho, Jing Wan, Shannon L. Risacher, Andrew J. Saykin, and ADNI*

Computer-Aided Detection of Pulmonary Pathology in Pediatric Chest Radiographs ..... 619  
*André Mouton, Richard D. Pitcher, and Tania S. Douglas*

Toward Precise Pulmonary Nodule Descriptors for Nodule Type Classification ..... 626  
*Amal Farag, Shireen Elhabian, James Graham, Aly Farag, and Robert Falk*

Morphology-Guided Graph Search for Untangling Objects: *C. elegans* Analysis ..... 634  
*T. Riklin Raviv, V. Ljosa, A.L. Conery, F.M. Ausubel, A.E. Carpenter, P. Golland, and C. Wählby*

Automatic Cephalometric Evaluation of Patients Suffering from Sleep-Disordered Breathing ..... 642  
*Lior Wolf, Tamir Yedidya, Roy Ganor, Michael Chertok, Ariela Nachmani, and Yehuda Finkelstein*

Fusion of Local and Global Detection Systems to Detect Tuberculosis in Chest Radiographs ..... 650  
*Laurens Hogeweg, Christian Mol, Pim A. de Jong, Rodney Dawson, Helen Ayles, and Bram van Ginneken*

Novel Morphometric Based Classification via Diffeomorphic Based Shape Representation Using Manifold Learning . . . . .	658
<i>Rachel Sparks and Anant Madabhushi</i>	
Semi Supervised Multi Kernel (SeSMiK) Graph Embedding: Identifying Aggressive Prostate Cancer via Magnetic Resonance Imaging and Spectroscopy . . . . .	666
<i>Pallavi Tiwari, John Kurhanewicz, Mark Rosen, and Anant Madabhushi</i>	
<b>Author Index</b> . . . . .	675