PROCEEDINGS OF

Electronic Imaging

Science and Technology

Computational Imaging V

Charles A. Bouman
Eric L. Miller
Ilya Pollak
Editors

29–31 January 2007
San Jose, California, USA

Sponsored and Published by
IS&T—The Society of Imaging Science and Technology
SPIE—The International Society for Optical Engineering

SPIE Vol. 6498

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publishers are not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Computational Imaging V*, edited by Charles A. Bouman, Eric L. Miller, Ilya Pollak, Proceedings of SPIE-IS&T Electronic Imaging, SPIE Vol. 6498, Article CID Number (2007).

ISSN 0277-786X
ISBN 9780819466112

Copublished by
SPIE—The International Society for Optical Engineering
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone 1 360/676-3290 (Pacific Time) · Fax 1 360/647-1445
http://www.spie.org
and
IS&T—The Society for Imaging Science and Technology
7003 Kilworth Lane, Springfield, Virginia, 22151 USA
Telephone 1 703/642-9090 (Eastern Time) · Fax 1 703/642-9094
http://www.imaging.org

Copyright © 2007, The Society of Photo-Optical Instrumentation Engineers and The Society for Imaging Science and Technology.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE and IS&T subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is $18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at http://www.copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/07/$18.00.

Printed in the United States of America.

Contents

ix *Conference Committee*

SESSION 1 MEDICAL IMAGING I

649803 **Analysis of reconstructions in full view fluorescence molecular tomography** [6498-01]
D. Hyde, A. Soubret, J. Dunham, T. Lasser, E. Miller, D. Brooks, V. Ntziachristos, Northeastern Univ. (USA), Tufts Univ. (USA), and Massachusetts General Hospital, Harvard Medical School (USA)

649804 **Image reconstruction for small animal SPECT with two opposing half cones** [6498-02]
Y. Zheng, Univ. of Virginia (USA); H. Li, Univ. of Texas (USA); J. Wang, A. V. Stolin, J. Pole, M. B. Williams, Univ. of Virginia (USA)

649805 **Regularized reconstruction of dynamic gated cardiac SPECT images** [6498-03]
M. Jin, Y. Yang, Illinois Institute of Technology (USA)

649806 **Image reconstruction performance as a function of model complexity using information geometry: application to transmission tomographic imaging** [6498-04]
J. A. O'Sullivan, L. Xie, Washington Univ. (USA); D. G. Politte, B. R. Whiting, Washington Univ. School of Medicine (USA)

SESSION 2 MOSAICING, INTERPOLATION, SUPER-RESOLUTION

649807 **Creating panoramas on mobile phones** [6498-05]
J. J. Boutellier, M. Bordallo-Lopez, O. Silvén, Univ. of Oulu (Finland); M. Tico, M. Vehviläinen, Nokia Research Ctr. (Finland)

Pagination: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication.

SPIE uses a six-digit CID article numbering system in which:
• The first four digits correspond to the SPIE volume number.
• The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

649808 **Multidimensional image enhancement from a set of unregistered differently exposed images** [6498-06]
A. A. Rad, L. Meylan, P. Vandewalle, S. Süsstrunk, École Polytechnique Fédérale de Lausanne (Switzerland)

649809 **Graph-based multiple panorama extraction from unordered image sets** [6498-07]
A. Sibiryakov, M. Bober, Mitsubishi Electric ITE B.V. (United Kingdom)

64980A **Image interpolation using multiscale geometric representations** [6498-08]
N. Mueller, Y. Lu, M. N. Do, Univ. of Illinois at Urbana-Champaign (USA)

SESSION 3 SEGMENTATION AND SHAPE ANALYSIS

64980D **4D segmentation of cardiac data using active surfaces with spatiotemporal shape priors** [6498-11]
A. Abufadel, T. Yezzi, Georgia Institute of Technology (USA); R. Schafer, Hewlett-Packard Labs. (USA)

64980E **Automated segmentation of alloy microstructures in serial section images** [6498-12]
J. M. Dumke, M. L. Comer, Purdue Univ. (USA)

64980F **Fast Mumford-Shah segmentation using image scale space bases** [6498-13]
C. V. Alvino, A. J. Yezzi, Georgia Institute of Technology (USA)

SESSION 4 COMPRESSION AND COMPRESSED SENSING

64980G **Shape representation via conformal mapping** [6498-14]
M. Feiszli, D. Mumford, Brown Univ. (USA)

64980H **The smashed filter for compressive classification and target recognition** [6498-15]
M. A. Davenport, M. F. Duarte, Rice Univ. (USA); M. B. Wakin, California Institute of Technology (USA); J. N. Laska, D. Takhar, K. F. Kelly, R. G. Baraniuk, Rice Univ. (USA)

64980J **Variational methods for compressive sampling** [6498-17]
J. Romberg, Georgia Institute of Technology (USA)

64980K **Compression of noisy Bayer pattern color filter array images** [6498-18]
V. V. Lukin, N. N. Ponomarenko, National Aerospace Univ. (Ukraine); A. V. Bazhyna, K. O. Egiazarian, Tampere Univ. of Technology (Finland)

64980L **Multiscale reconstruction for computational spectral imaging** [6498-19]
R. M. Willett, Duke Univ. (USA); M. E. Gehm, Univ. of Arizona (USA); D. J. Brady, Duke Univ. (USA)

SESSION 5 HARDWARE SYSTEMS FOR IMAGING AND TOMOGRAPHY

64980N **Why do commodity graphics hardware boards (GPUs) work so well for acceleration of computed tomography? (Keynote Paper)** [6498-20]
K. Mueller, F. Xu, N. Neophytou, Stony Brook Univ. (USA)

64980P **Tomographic image reconstruction using the cell broadband engine (CBE) general purpose hardware** [6498-22]
M. Knaup, S. Steckmann, Univ. of Erlangen-Nürnberg (Germany); O. Bockenbach, Mercury Computer Systems GmbH (Germany); M. Kachelrieß, Univ. of Erlangen-Nürnberg (Germany)

64980Q **Iterative reconstruction of cone-beam CT data on a cluster** [6498-23]
T. M. Benson, GE Global Research (USA); J. Gregor, The Univ. of Tennessee, Knoxville (USA)

64980R **Evolution of computer technology for fast cone-beam backprojection** [6498-51]
I. Goddard, A. Berman, Mercury Computer Systems, Inc. (USA); O. Bockenbach, Mercury Computer Systems GmbH (Germany); F. Lauginiger, Mercury Computer Systems, Inc. (USA); S. Schuberth, Mercury Computer Systems GmbH (Germany); S. Thieret, Mercury Computer Systems, Inc. (USA)

SESSION 6 RESTORATION, FILTERING, AND RECONSTRUCTION

64980S **Higher order bilateral filters and their properties** [6498-24]
H. Takeda, S. Farsiu, P. Milanfar, Univ. of California, Santa Cruz (USA)

64980T **The use of levelable regularization functions for MRF restoration of SAR images while preserving reflectivity** [6498-25]
J. Darbon, Univ. of California, Los Angeles (USA) and EPITA (France); M. Sigelle, F. Tupin, École Nationale Supérieure des Télécommunications (France)

64980U **Nonlocal evolutions for image regularization** [6498-26]
G. Gilboa, S. Osher, Univ. of California, Los Angeles (USA)

64980V **Parametric point spread function modeling and reduction of stray light effects in digital still cameras** [6498-27]
B. Bitlis, Purdue Univ. (USA); P. A. Jansson, College of Optical Sciences, The Univ. of Arizona (USA); J. P. Allebach, Purdue Univ. (USA)

64980W **An image decomposition model using the total variation and the infinity Laplacian** [6498-28]
C. Elion, L. A. Vese, Univ. of California, Los Angeles (USA)

SESSION 7 TRACKING, RECOGNITION, AND SCENE ANALYSIS

64980Y **Symmetry detection in 3D scenes** [6498-30]
T. Sawada, Z. Pizlo, Purdue Univ. (USA)

64980Z **Object recognition via information: theoretic measures/metrics** [6498-31]
D. W. Repperger, A. R. Pinkus, Air Force Research Lab. (USA); J. A. Skipper, C. D. Schrider, Wright State Univ. (USA)

SESSION 8 MULTIGRID METHODS

649810 **Multigrid optimal mass transport for image registration and morphing** [6498-32]
T. u. Rehman, A. Tannenbaum, Georgia Institute of Technology (USA)

649811 **The effect of intergrid operators on multigrid convergence** [6498-33]
P. Navarrete, Purdue Univ. (USA) and Univ. de Chile (Chile); E. J. Coyle, Purdue Univ. (USA)

SESSION 9 IMAGING IN MATERIALS SCIENCE

649812 **Using transmission electron microscopy to quantify the spatial distribution of nanoparticles suspended in a film** [6498-34]
S. Newsam, E. Pernice, J. Jasinski, V. Leppert, Univ. of California, Merced (USA)

SESSION 10 RECONSTRUCTION, INPAINTING, AND PREDICTION

649813 **Image inpainting based on energy minimization** [6498-35]
N. Kawai, T. Sato, N. Yokoya, Nara Institute of Science and Technology (Japan)

649814 **Signal reconstruction from a periodic nonuniform set of samples using H_∞ optimization** [6498-36]
Ha. T. Nguyen, M. N. Do, Univ. of Illinois at Urbana-Champaign (USA)

649815 **A multiscale statistical model for time series forecasting** [6498-54]
W. Wang, I. Pollak, Purdue Univ. (USA)

SESSION 11 MEDICAL IMAGING II

649816 **Simultaneous surface and volume registration using harmonic maps** [6498-49]
A. A. Joshi, Univ. of Southern California (USA); D. W. Shattuck, P. M. Thompson, Univ. of California, Los Angeles (USA); R. M. Leahy, Univ. of Southern California (USA)

649817 **Regional approach to fMRI data analysis using hemodynamic response modeling** [6498-37]
L. Liu, A. A. Rao, Purdue Univ. (USA); T. M. Talavage, Purdue Univ. (USA) and Indiana Univ. School of Medicine (USA)

649818 **Fast joint estimation of local magnitude, decay, and frequency from single-shot MRI** [6498-38]
W. Tang, S. J. Reeves, Auburn Univ. (USA); D. B. Twieg, The Univ. of Alabama, Birmingham (USA)

SESSION 12 MEDICAL IMAGING III

649819 **High-resolution image reconstruction for PET using estimated detector response functions** [6498-39]
M. S. Tohme, J. Qi, Univ. of California, Davis (USA)

64981A **High resolution projection reconstruction MR imaging using FOCUSS** [6498-40]
S. Tak, J. Yoo, J. C. Ye, Korea Advanced Institute of Science & Technology (South Korea)

64981B **Non-homogeneous updates for the iterative coordinate descent algorithm** [6498-41]
Z. Yu, Purdue Univ. (USA); J.-B. Thibault, GE Healthcare Technologies (USA); C. A. Bouman, Purdue Univ. (USA); K. D. Sauer, Univ. of Notre Dame (USA); J. Hsieh, GE Healthcare Technologies (USA)

64981C **Statistical modelling of the myosin lattice in vertabrate muscle** [6498-53]
C. H. Yoon, R. P. Millane, N. D. Blakeley, A. Goyal, Univ. of Canterbury (New Zealand)

SESSION 13 COLOR IMAGING

64981D **Training-based algorithm for moiré suppression in scanned halftone images** [6498-55]
H. Siddiqui, C. A. Bouman, Purdue Univ. (USA)

POSTER SESSION

64981E **A computational 3D model for reconstruction of neural stem cells in bright-field time-lapse microscopy** [6498-44]
J. Degerman, Chalmers Univ. of Technology (Sweden); E. Winterfors, Univ. Pierre et Marie Curie (France); J. Faijerson, Sahlgrenska Academy at Göteborg Univ. (Sweden); T. Gustavsson, Chalmers Univ. of Technology (Sweden)

64981F **Empirical evaluation of dissimilarity measures for use in urban structural damage detection** [6498-45]
Z. Chen, T. C. Hutchinson, Univ. of California, San Diego (USA)

64981G **Cryo-electron microscopy single particle reconstruction of virus particles using compressed sensing theory** [6498-46]
M. W. Kim, J. Choi, L. Yu, Korea Advanced Institute of Science and Technology (South Korea); K. E. Lee, S.-S. Han, Korea Univ. (South Korea); J. C. Ye, Korea Advanced Institute of Science and Technology (South Korea)

64981H **GPU-based visualization techniques for 3D microscopic imaging data** [6498-47]
Q. Wang, Y. Sun, J. P. Robinson, Purdue Univ. (USA)

64981I **GICEB: automatic segmentation algorithm for biomedical images** [6498-48]
Q. Wang, N. Vaidhyanathan, F. Vadakkumpadan, Y. Sun, Purdue Univ. (USA)

Author Index

Conference Committee

Symposium Chairs

Michael A. Kriss, Consultant (USA)
Robert A. Sprague, Consultant (USA)

Conference Chairs

Charles A. Bouman, Purdue University (USA)
Eric L. Miller, Northeastern University (USA)
Ilya Pollak, Purdue University (USA)

Program Committee

Samit K. Basu, GE Global Research (USA)
Thomas S. Denney, Jr., Auburn University (USA)
Peter C. Doerschuk, Purdue University (USA)
Peyman Milanfar, University of California, Santa Cruz (USA)
Joseph A. O'Sullivan, Washington University in St. Louis (USA)
Zygmunt Pizlo, Purdue University (USA)
Stanley J. Reeves, Auburn University (USA)
Yongyi Yang, Illinois Institute of Technology (USA)
Yibin Zheng, University of Virginia (USA)

Session Chairs

1 Medical Imaging I
Eric L. Miller, Northeastern University (USA)

2 Mosaicing, Interpolation, Super-resolution
Mary L. Comer, Purdue University (USA)

3 Segmentation and Shape Analysis
Ilya Pollak, Purdue University (USA)

4 Compression and Compressed Sensing
Rebecca M. Willett, Duke University (USA)

5 Hardware Systems for Imaging and Tomography
Samit K. Basu, GE Global Research (USA)

6 Restoration, Filtering, and Reconstruction
Peyman Milanfar, University of California, Santa Cruz (USA)

7 Tracking, Recognition, and Scene Analysis
Zygmunt Pizlo, Purdue University (USA)

8 Multigrid Methods
Charles A. Bouman, Purdue University (USA)

9 Imaging in Materials Science
Charles A. Bouman, Purdue University (USA)

10 Reconstruction, Inpainting, and Prediction
Minh N. Do, University of Illinois at Urbana-Champaign (USA)

11 Medical Imaging II
Thomas Talavage, Purdue University (USA)