PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 6515

, "Front Matter: Volume 6515," Proc. SPIE 6515, Medical Imaging 2007: Image Perception, Observer Performance, and Technology Assessment, 651501 (30 March 2007); doi: 10.1117/12.730747

SPIE.

Event: Medical Imaging, 2007, San Diego, CA, United States

Medical Imaging 2007

Image Perception, Observer Performance, and Technology Assessment

**Yulei Jiang
Berkman Sahiner**
Editors

**21–22 February 2007
San Diego, California, USA**

Sponsored and Published by
SPIE—The International Society for Optical Engineering

Cooperating Organizations

AAPM—American Association of Physicists in Medicine (USA)
APS—American Physiological Society (USA)
CARS—Computer Assisted Radiology and Surgery (Germany)
IS&T—The Society for Imaging Science and Technology
MIPS—Medical Image Perception Society (USA)
RSNA—Radiological Society of North America (USA)
SIIM—Society for Imaging Informatics in Medicine (USA)
SMI—The Society for Molecular Imaging
The DICOM Standards Committee (USA)

Volume 6515

The International Society
for Optical Engineering

Proceedings of SPIE—The International Society for Optical Engineering, 9780819466334, v. 6515

SPIE is an international technical society dedicated to advancing engineering and scientific applications of optical, photonic, imaging, electronic, and optoelectronic technologies.

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 publisher is 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 *Medical Imaging 2007: Image Perception, Observer Performance, and Technology Assessment*, edited by Yulei Jiang, Berkman Sahiner, Proceedings of SPIE Vol. 6515 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 1605-7422
ISBN 9780819466334

Published 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>

Copyright © 2007, The Society of Photo-Optical Instrumentation Engineers

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 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 1605-7422/07/\$18.00.

Printed in the United States of America.

Contents

xi	Conference Committee
xiii	Introduction

SESSION 1   ROC METHODS

- 651502   **Describing three-class task performance: three-class linear discriminant analysis and three-class ROC analysis** [6515-01]
X. He, E. C. Frey, Johns Hopkins School of Medicine (USA)
- 651503   **A utility-based performance metric for ROC analysis of N-class classification tasks** [6515-02]
D. C. Edwards, C. E. Metz, Univ. of Chicago (USA)
- 651504   **Estimation ROC curves and their corresponding ideal observers** [6515-03]
E. Clarkson, College of Optical Sciences/Univ. of Arizona (USA) and Univ. of Arizona (USA)
- 651505   **A bivariate binormal ROC methodology for comparing new methods to an existing standard for screening applications** [6515-04]
C. K. Abbey, Univ. of California/Santa Barbara (USA) and Univ. of California/Davis (USA);
M. F. Insana, Univ. of Illinois at Urbana-Champaign (USA); M. P. Eckstein, Univ. of
California/Santa Barbara (USA); J. M. Boone, Univ. of California/Davis (USA) and U.C. Davis
Medical Center (USA)
- 651506   **Pooling MRMC forced-choice data** [6515-05]
B. D. Gallas, G. A. Pennello, NIBIB/CDRH Lab. for the Assessment of Medical Imaging
Systems (USA)

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.

- 651507 **A proposal of the evaluation method of the effectiveness of CAD use by means of the bias with variance characteristic (BVC) analysis and the internal structure analysis of the ROC-curve** [6515-44]
T. Matsumoto, A. Furukawa, K. Nisizawa, National Institute of Radiological Sciences (Japan); S. Wada, Niigata Univ. (Japan); S. Yamamoto, Chukyo Univ. (Japan); K. Murao, Fujitsu Ltd. (Japan); M. Matsumoto, Diichi Hospital (Japan); S. Sone, JA Azumi General Hospital (Japan); K. Fukuhisa, T. Iinuma, Y. Tateno, National Institute of Radiological Sciences (Japan)

SESSION 2 HAROLD KUNDEL HONORARY LECTURE AND IMAGE PERCEPTION

- 651508 **How to minimize perceptual error and maximize expertise in medical imaging** (Keynote Paper) [6515-06]
H. L. Kundel, Univ. of Pennsylvania Health Sciences Ctr. (USA)
- 651509 **Visual search characteristics in mammography: malignant vs. benign breast masses** [6515-07]
C. Mello-Thoms, Univ. of Pittsburgh (USA)
- 65150A **Evaluating user interfaces for stack mode viewing** [6515-08]
M. S. Atkins, A. E. Kirkpatrick, A. Knight, Simon Fraser Univ. (Canada); B. Forster, Univ. of British Columbia (Canada)
- 65150B **Evaluation of perception performance in neck dissection planning using eye tracking and attention landscapes** [6515-09]
O. Burgert, V. Örn, Univ. of Leipzig (Germany); B. M. Velichkovsky, Technical Univ. of Dresden (Germany); M. Gessat, Univ. of Leipzig (Germany); M. Joos, Technical Univ. of Dresden (Germany) and Interactive Minds Dresden GmbH (Germany); G. Strauß, Univ. of Leipzig (Germany); C. Tietjen, B. Preim, Univ. of Magdeburg (Germany); I. Hertel, Univ. of Leipzig (Germany)
- 65150C **Remote vs. head-mounted eye-tracking: a comparison using radiologists reading mammograms** [6515-48]
C. Mello-Thoms, D. Gur, Univ. of Pittsburgh (USA)
- 65150E **Comparison of human observers and CDCOM software reading for CDMAM images** [6515-53]
N. Lanconelli, Univ. of Bologna (Italy); S. Rivetti, P. Golinelli, M. Serafini, Azienda USL di Modena (Italy); M. Bertolini, G. Borasi, Arcispedale Santa Maria Nuova (Italy)
- 65150F **How much is enough? Factors affecting the optimal interpretation of breast screening mammograms** (Cum Laude Poster Award) [6515-54]
H. J. Scott, A. G. Gale, Loughborough Univ. (United Kingdom)
- 65150G **The dependency of pixel size on calcification reproducibility in digital mammography** [6515-55]
T. Kuwabara, N. Iwasaki, K. Yamane, T. Kojima, K. Fukushima, T. Agano, Fujifilm Corp. (Japan)

- 65150H **Evaluation of the global effect of anatomical background on microcalcifications detection** (Honorable Mention Poster Award) [6515-56]
F. Zanca, C. Van Ongeval, J. Jacobs, Leuven Univ. Ctr. of Medical Physics in Radiology (Belgium); P. Pöyry, STUK-Radiation and Nuclear Safety Authority (Finland); G. Marchal, H. Bosmans, Leuven Univ. Ctr. of Medical Physics in Radiology (Belgium)
- 65150J **A software system for the simulation of chest lesions** [6515-61]
J. T. Ryan, M. McEntee, S. Barrett, Univ. College Dublin (Ireland); M. Evanoff, American Board of Radiology (USA); D. Manning, St. Martins College, University of Lancaster (United Kingdom); P. Brennan, Univ. College Dublin (Ireland)
- 65150K **Development of surgical lighting for enhanced color contrast** [6515-63]
M. Litorja, S. W. Brown, M. Nadal, D. Allen, National Institute of Standards and Technology (USA); A. Gorbach, National Institutes of Health (USA)

SESSION 3 IMAGE DISPLAY

- 65150L **Influence of 8-bit versus 11-bit digital displays on observer performance and visual search: a multi-center evaluation** [6515-10]
E. A. Krupinski, Univ. of Arizona (USA); K. Siddiqui, VA Maryland Health Care System (USA); E. Siegel, Univ. of Maryland/Baltimore (USA); R. Shrestha, E. Grant, Univ. of Southern California (USA); H. Roehrig, J. Fan, Univ. of Arizona (USA)
- 65150M **Ambient lighting: setting international standards for the viewing of softcopy chest images** [6515-11]
M. F. McEntee, J. Ryan, Univ. College Dublin (Ireland); M. G. Evanoff, American Board of Radiology (USA); A. Keeling, Beaumont Hospital (Ireland); D. Chakraborty, Univ. of Pittsburgh (USA); D. Manning, St. Martin's College Lancaster (United Kingdom); P. C. Brennan, National Univ. of Ireland/Dublin (Ireland)
- 65150N **Grayscale standard display function on LCD color monitors** [6515-12]
D. De Monte, C. Casale, L. Albani, S. Bonfiglio, FIMI Philips (Italy)
- 65150O **A comparison between 8-bit and 10-bit luminance resolution when generating low-contrast sinusoidal test pattern on an LCD** [6515-13]
P. Sund, M. Båth, Sahlgrenska Univ. Hospital (Sweden) and Göteborg Univ. (Sweden); L. Ungsten, Sahlgrenska Univ. Hospital (Sweden); L. G. Månsson, Sahlgrenska Univ. Hospital (Sweden) and Göteborg Univ. (Sweden)
- 65150P **Visual image quality metrics for optimization of breast tomosynthesis acquisition technique** [6515-14]
J. P. Johnson, Siemens Corporate Research (USA); J. Lo, Duke Univ. Medical Ctr. (USA); T. Mertelmeier, Siemens AG (Germany); J. S. Nafziger, Siemens Corporate Research (USA); P. Timberg, Lunds Univ., Malmö Univ. Hospital (Sweden); E. Samei, Duke Univ. Medical Ctr. (USA)
- 65150Q **Do aging displays impact observer performance and visual search efficiency?** [6515-45]
E. A. Krupinski, H. Roehrig, J. Fan, Univ. of Arizona (USA)

- 65150R **High luminance monochrome vs low luminance monochrome and color softcopy displays: observer performance and visual search efficiency** [6515-46]
E. A. Krupinski, H. Roehrig, J. Fan, Univ. of Arizona (USA); T. Yoneda, Eizo Nanao Corp. (Japan)

SESSION 4 MODEL OBSERVERS I

- 65150S **Bias in Hotelling observer performance computed from finite data** [6515-15]
M. A. Kupinski, E. Clarkson, J. Y. Hesterman, The Univ. of Arizona (USA)
- 65150T **Adaptive Hotelling discriminant functions** [6515-16]
A. Brème, M. A. Kupinski, E. Clarkson, H. H. Barrett, College of Optical Sciences, The Univ. of Arizona (USA)
- 65150U **Mass detection on real and synthetic mammograms: human observer templates and local statistics** [6515-17]
C. Castella, Institut Univ. de Radiophysique Appliquée (Switzerland); K. Kinkel, Clinique des Grangettes (Switzerland); F. R. Verdun, Institut Univ. de Radiophysique Appliquée (Switzerland); M. P. Eckstein, C. K. Abbey, Univ. of California/Santa Barbara (USA); F. O. Bochud, Institut Univ. de Radiophysique Appliquée (Switzerland)
- 65150V **A contrast-sensitive channelized-Hotelling observer to predict human performance in a detection task using lumpy backgrounds and Gaussian signals** [6515-18]
S. Park, A. Badano, B. D. Gallas, K. J. Myers, Ctr. for Devices and Radiological Health, FDA (USA)
- 65150W **Effect of slow display on stack-mode reading of volumetric image datasets using an anthropomorphic observer** [6515-19]
H. Liang, S. Park, B. D. Gallas, A. Badano, NIBIB/CDRH Lab. for the Assessment of Medical Imaging Systems, FDA (USA)
- 65150X **Validation of closed-form compression noise statistics using model observers** [6515-20]
D. Li, Texas Instruments Inc. (USA); M. Loew, George Washington Univ. (USA)

SESSION 5 FROC, LROC, AND OTHER ANALYSES

- 65150Y **FROC curves using a model of visual search** [6515-21]
D. P. Chakraborty, Univ. of Pittsburgh (USA)
- 65150Z **A non-intuitive aspect of Swensson's LROC model** [6515-22]
P. F. Judy, Brigham and Women's Hospital and Harvard Medical School (USA)
- 651510 **Approximating the test statistic distribution and ALROC in signal-detection tasks with signal location uncertainty** [6515-23]
F. Shen, Univ. of Arizona (USA); E. Clarkson, College of Optical Sciences, Univ. of Arizona (USA)
- 651511 **A Bayesian interpretation of the "proper" binormal ROC model using a uniform prior distribution for the area under the curve** [6515-24]
R. M. Zur, L. L. Pesce, Y. Jiang, C. E. Metz, Univ. of Chicago (USA)

- 651512 **Advanced system model for the prediction of the clinical task performance of radiographic systems** [6515-25]
K. Töpfer, Eastman Kodak Co. (USA); B. W. Keelan, Micron Technology, Inc. (USA); F. Sugiro, Eastman Kodak Co. (USA)

SESSION 6 MODEL OBSERVERS II

- 651513 **Perception of dim targets on dark backgrounds in MRI** [6515-26]
M. D. Tisdall, M. S. Atkins, Simon Fraser Univ. (Canada)
- 651514 **Evaluation of the channelized Hotelling observer for signal detection in 2D tomographic imaging** [6515-27]
S. J. LaRoque, E. Y. Sidky, D. C. Edwards, X. Pan, Univ. of Chicago (USA)
- 651515 **Perceptual difference model (Case-PDM) for evaluation of MR images: validation and calibration** [6515-28]
J. Miao, Case Western Reserve Univ. (USA); D. Huo, St. Joseph Hospital and Medical Center (USA); D. Wilson, Case Western Reserve Univ. (USA) and Univ. Hospitals of Cleveland (USA)
- 651516 **Markov chain Monte Carlo (MCMC) based ideal observer estimation using a parameterized phantom and a pre-calculated dataset** [6515-29]
X. He, Johns Hopkins School of Medicine (USA); B. S. Caffo, Johns Hopkins Bloomberg School of Public Health (USA); E. C. Frey, Johns Hopkins School of Medicine (USA)
- 651517 **Task-based evaluation of practical lens designs for lens-coupled digital mammography systems** [6515-30]
L. Chen, Univ. of Arizona (USA); L. D. Foo, Optical Research Associates (USA); R. L. Cortesi, Institute of Optics, Univ. of Rochester (USA); K. P. Thompson, Optical Research Associates (USA); H. H. Barrett, Univ. of Arizona (USA) and College of Optical Sciences, Univ. of Arizona (USA)
- 651518 **Tools and methods for exposure control optimization in digital mammography in presence of texture** [6515-31]
B. Grosjean, Ecole Centrale Paris (France) and GE Healthcare France (France); S. Muller, H. Souchay, GE Healthcare France (France)
- 651519 **Combining a wavelet transform with a channelized Hotelling observer for tumor detection in 3D PET oncology imaging** [6515-50]
C. Lartizen, S. Tomei, V. Maxim, C. Odet, CREATIS, CNRS, INSA Lyon, Univ. Lyon 1 (France)

SESSION 7 TECHNOLOGY ASSESSMENT I

- 65151C **Performance analysis for computer-aided lung nodule detection on LIDC data** [6515-32]
R. Opfer, R. Wiemker, Philips Research Europe (Germany)
- 65151D **Effect of CAD on radiologists' detection of lung nodules on thoracic CT scans: observer performance study** [6515-33]
B. Sahiner, L. M. Hadjiiski, H.-P. Chan, J. Shi, P. N. Cascade, E. A. Kazerooni, C. Zhou, J. Wei, A. R. Chughtai, C. Poopat, T. Song, J. S. Nojkova, L. Frank, A. Attili, Univ. of Michigan (USA)

- 65151E **Reducing variability in the output of artificial neural networks through output calibration** [6515-34]
S. Gupta, W. C. Kan, T. C. Lin, M. K. Markey, Univ. of Texas at Austin (USA)
- 65151F **Technology assessment: observer study directly compares screen/film to CR mammography** [6515-35]
L. Fletcher-Heath, A. Richards, S. Ryan-Kron, Eastman Kodak Co. (USA)
- 65151G **Evaluation of hardware in a small-animal SPECT system using reconstructed images** [6515-36]
J. Y. Hesterman, College of Optical Sciences, Univ. of Arizona (USA); M. A. Kupinski, E. Clarkson, College of Optical Sciences, Univ. of Arizona (USA) and Univ. of Arizona (USA); D. W. Wilson, Univ. of Arizona (USA); H. H. Barrett, College of Optical Sciences, Univ. of Arizona (USA) and Univ. of Arizona (USA)

SESSION 8 TECHNOLOGY ASSESSMENT II

- 65151H **A method for analyzing contrast-detail curves** [6515-37]
K. M. Ogden, W. Huda, K. Shah, E. M. Scalzetti, R. L. Lavallee, M. L. Roskopf, SUNY Upstate Medical Univ. (USA)
- 65151I **WorkstationJ: workstation emulation software for medical image perception and technology evaluation research** [6515-38]
K. M. Scharz, K. S. Berbaum, R. T. Caldwell, M. T. Madsen, Univ. of Iowa (USA)
- 65151J **Automatic evaluation of uterine cervix segmentations** [6515-39]
S. Lotenberg, S. Gordon, Tel Aviv Univ. (Israel); R. Long, S. Antani, National Library of Medicine, National Institutes of Health (USA); J. Jeronimo, National Cancer Institute, National Institutes of Health (USA); H. Greenspan, Tel Aviv Univ. (Israel)
- 65151K **Improved detection of coronary artery calcifications using dual energy subtraction radiography** [6515-40]
R. S. Lazebnik, Univ. Hospitals of Cleveland (USA) and Stanford Univ. Medical Ctr. (USA); P. B. Sachs, R. C. Gilkeson, Univ. Hospitals of Cleveland (USA)
- 65151L **Visual quality assessment of watermarked medical images** [6515-41]
J. A. Dowling, B. M. Planitz, A. J. Maeder, e-Health Research Ctr./CSIRO (Australia); J. Du, Queensland Univ. of Technology (Australia); B. Pham, C. Boyd, Queensland Univ. of Technology (Australia) and National ICT Australia (Australia); S. Chen, Univ. of Queensland (Australia); A. P. Bradley, S. Crozier, Univ. of Queensland (Australia) and National ICT Australia (Australia)
- 65151M **Evaluation of an interactive computer-aided diagnosis (ICAD) system for mammography: a pilot study** [6515-42]
B. Zheng, G. Abrams, C. A. Britton, C. M. Hakim, A. Lu, R. J. Clearfield, J. Drescher, G. S. Maitz, D. Gur, Univ. of Pittsburgh (USA)
- 65151N **Observer evaluation of computer-aided detection: second reader versus concurrent reader scenario** [6515-43]
S. Paquerault, D. I. Wade, N. Petrick, K. J. Myers, F. W. Samuelson, NIBIB/CDRH Lab. for the Assessment of Medical Imaging Systems, FDA (USA)

- 65151O **A new image-quality evaluation method for low-contrast resolution in computed tomography** [6515-47]
T. Akita, N. Yagi, National Cancer Ctr. Hospital East (Japan)
- 65151P **Performance evaluation of CT-automatic exposure control devices** [6515-57]
D. Gutierrez, Univ. Institute for Radiation Physics (Switzerland); S. Schmidt, A. Denys, P. Schnyder, Univ. Hospital of Lausanne (Switzerland); F. O. Bochud, F. R. Verdun, Univ. Institute for Radiation Physics (Switzerland)
- 65151Q **Multi-center MRI volume and linearity behavior** [6515-59]
M. Barbu-McInnis, L. Molinelli, E. Durkin, J. Tamez-Peña, S. Totterman, VirtualScopics, Inc. (USA)
- 65151R **Clinical evaluation of new workflow-efficient image processing for digital radiography** [6515-60]
L. L. Barski, M. Couwenhoven, X. Wang, L. Fletcher-Heath, Eastman Kodak Co. (USA); M. Dupin, Consultant (USA); D. S. Katz, A. P. Price, A.-O. Kranz, A. O. Ortiz, B. Motroni, L. Belfi, Winthrop-Univ. Hospital (USA); D. H. Foos, Eastman Kodak Co. (USA)
- 65151S **Implementing a large-scale multicentric study for evaluation of lossy JPEG and JPEG2000 medical image compression: challenges and rewards** [6515-62]
D. Koff, Sunnybrook Health Sciences Ctr. (Canada); P. Bak, Canada Health Infoway (Canada); A. Volkening, H. Shulman, Sunnybrook Health Sciences Ctr. (Canada); P. Brownrigg, Fraser Health Authority (Canada); L. Lepanto, CHUM-Hôpital Saint Luc (Canada); T. Michalak, A. Kiss, Sunnybrook Health Sciences Ctr. (Canada)

Author Index

Conference Committee

Symposium Chairs

Elizabeth A. Krupinski, University of Arizona (USA)
Milan Sonka, University of Iowa (USA)
Amir A. Amini, University of Louisville (USA)

Conference Chairs

Yulei Jiang, University of Chicago (USA)
Berkman Sahiner, University of Michigan (USA)

Program Committee

Craig K. Abbey, University of California, Santa Barbara (USA)
Kevin S. Berbaum, University of Iowa Hospitals and Clinics (USA)
Brandon D. Gallas, CDRH/FDA and NIBIB/NIH Joint Laboratory for the
Assessment of Medical Imaging Systems (USA)
Matthew A. Kupinski, College of Optical Sciences, University of Arizona
(USA)
David J. Manning, St. Martin's College, University of Lancaster (United
Kingdom)
Claudia Mello-Thoms, University of Pittsburgh (USA)
David L. Wilson, Case Western Reserve University (USA)

Session Chairs

Workshop: Validation of Models used in Assessment of Medical Imaging
Systems

Aldo Badano, CDRH/FDA and NIBIB/NIH Joint Laboratory for the
Assessment of Medical Imaging Systems (USA)

Kyle J. Myers, CDRH/FDA and NIBIB/NIH Joint Laboratory for the
Assessment of Medical Imaging Systems (USA)

- 1 ROC Methods
Brandon D. Gallas, CDRH/FDA and NIBIB/NIH Joint Laboratory for the
Assessment of Medical Imaging Systems (USA)
- 2 Harold Kundel Honorary Lecture and Image Perception
Elizabeth A. Krupinski, University of Arizona (USA)
- 3 Image Display
David J. Manning, St. Martin's College, University of Lancaster (United
Kingdom)

- 4 Model Observers I
Kevin S. Berbaum, University of Iowa Hospitals and Clinics (USA)
- 5 FROC, LROC, and Other Analyses
Yulei Jiang, University of Chicago (USA)
- 6 Model Observers II
Matthew A. Kupinski, College of Optical Sciences, University of Arizona (USA)
- 7 Technology Assessment I
Berkman Sahiner, University of Michigan (USA)
- 8 Technology Assessment II
Claudia Mello-Thoms, University of Pittsburgh (USA)

Introduction

As part of the symposium of SPIE Medical Imaging 2007, the Image Perception, Observer Performance, and Technology Assessment Conference was held February 20 through 22, 2007, in San Diego, California. In the evening of February 20, the conference opened with a workshop entitled "Validation of models used in assessment of medical imaging systems." Aldo Badano and Kyle J. Myers, Center for Devices and Radiological Health of the U.S. Food and Drug Administration and the National Institute of Biomedical Imaging and Bioengineering of the National Institutes of Health, chaired the workshop. Seven other experts gave brief presentations and then joined in a spirited panel discussion. The panelists were Josep Sempau, Universitat Politècnica de Catalunya; David L. Wilson, Case Western Reserve University; Benjamin M. W. Tsui, Johns Hopkins University; Mathew A. Kupinski, University of Arizona; Predrag R. Bakic, University of Pennsylvania; Stephen Glick, University of Massachusetts Medical School; and Craig K. Abbey, University of California at Santa Barbara.

The workshop was hosted jointly with the Physics of Medical Imaging Conference. This was the first time that the two conferences collaborated in hosting a workshop on an area of research that intersects the interests of the attendees of both conferences. The workshop touched on a wide range of topics from simulation of electron transfer in complex imaging systems to prediction of human observer performance with mathematical models. The panelists highlighted the importance of validation for Monte Carlo simulations and mathematical models and they also showed the difficulties involved in performing such validation. Questions were raised during the discussion regarding whether modeling can reduce at least some of the burden of large-scale trials and it was clear that more research would follow to address those questions.

Harold L. Kundel, University of Pennsylvania, presented the keynote lecture. Before his lecture, Elizabeth A. Krupinski, University of Arizona, who has been involved in organizing this conference and the Medical Imaging Symposium for many years, presented Dr. Kundel with a plaque that designated the keynote lecture of this conference as the annual Harold L. Kundel, M.D., Honorary Lecture. This designation recognizes the outstanding and unique contribution Dr. Kundel has made to the field of medical image perception. Dr. Kundel's inaugural lecture was entitled "How to minimize perceptual error and maximize expertise in medical imaging."

There were 40 contributed oral presentations organized in eight sessions: ROC methods; FROC, LROC, and other analyses; image perception; image display; two sessions on model observers; and two sessions on technology assessment. Some of the papers on ROC analysis generated excitement and interests that undoubtedly will continue at future meetings. There was a strong presence of

papers on model observers, occupying two oral sessions in addition to the discussions made at the workshop.

Yulei Jiang
Berkman Sahiner