Medical Imaging 2012

Image Perception, Observer Performance, and Technology Assessment

Craig K. Abbey
Claudia R. Mello-Thoms
Editors

8–9 February 2012
San Diego, California, United States

Sponsored by
SPIE

Cosponsored by
Agilent Technologies • Diamond SA (Switzerland) • DQE Instruments, Inc. (Canada)
eMagin (United States) • Isuzu Glass Co., Ltd. (Japan) • Medtronic, Inc. • Ocean Thin Films, Inc. (United States)

Cooperating Organizations
AAPM—American Association of Physicists in Medicine (United States) • CARS—Computer Assisted Radiology and Surgery (Germany) • Medical Image Perception Society (United States) • Radiological Society of North America (United States) • APS—American Physiological Society (United States) • The DICOM Standards Committee (United States) • Society for Imaging Informatics in Medicine (United States) • The Society for Imaging Science and Technology • World Molecular Imaging Society

Published by
SPIE

Volume 8318


SPIE is an international society advancing an interdisciplinary approach to the science and application of light.
## Contents

| xi  | Conference Committee |
| xiii | Fortieth anniversary of SPIE Medical Imaging meeting (Overview Paper)  
R. M. Nishikawa, Carl J. Vyborny  
Translation Lab. for Breast Imaging Research, The Univ. of Chicago (United States) |
| xxix | Image perception at SPIE: did you see what I saw? (Overview Paper)  
E. A. Krupinski, The Univ. of Arizona (United States) |

### TECHNOLOGY ASSESSMENT

| 8318 02 | CT detector evaluation with complex random backgrounds [8318-01]  
H. Fan, H. H. Barrett, College of Optical Sciences, The Univ. of Arizona (United States) and  
The Univ. of Arizona (United States) |
| 8318 03 | Reader behavior in a detection task using single- and multislice image datasets [8318-02]  
A. Kumcu, L. Platiša, Univ. Gent (Belgium); M. Platiša, TASS N.V. (Belgium); E. Vansteenkiste,  
Univ. Gent (Belgium); K. Deblaere, Gent Univ. Hospital (Belgium); A. Badano, U.S. Food and Drug Administration (United States); W. Philips, Univ. Gent (Belgium) |
| 8318 04 | An image-dependent model of veiling glare effects on detection performance in large-luminance-range displays [8318-03]  
M. Choi, U.S. Food and Drug Administration (United States); L. Albani, BARCO FIMI (Italy);  
A. Badano, U.S. Food and Drug Administration (United States) |
| 8318 05 | Visual grading regression with random effects [8318-04]  
Ö. Smedby, M. Fredrikson, J. De Geer, M. Sandborg, Linköping Univ. (Sweden) |
| 8318 06 | Computational observer approach for the assessment of stereoscopic visualizations for 3D medical images [8318-05]  
F. Zafar, Univ. of Maryland, Baltimore County (United States) and U.S. Food and Drug Administration (United States); J. Darband, Univ. of Maryland, Baltimore County (United States); A. Badano, U.S. Food and Drug Administration (United States) |

### IMAGE DISPLAY

| 8318 07 | Stereoscopic versus monoscopic detection of masses on breast tomosynthesis projection images [8318-06]  
G. S. Muralidhar, T. Ganapathi, A. C. Bovik, The Univ. of Texas at Austin (United States);  
M. K. Markey, The Univ. of Texas at Austin (United States) and The Univ. of Texas M.D. Anderson Cancer Ctr. (United States); T. M. Haygood, T. W. Stephens, G. J. Whitman, The Univ. of Texas M.D. Anderson Cancer Ctr. (United States) |
8318 08 The effect of fixed eye adaptation when using displays with a high luminance range
[8318-07]
P. Sund, L. G. Månsson, M. Båth, Sahlgrenska Univ. Hospital (Sweden) and Göteborg Univ. (Sweden)

8318 09 Perceptual enhancement of arteriovenous malformation in MRI angiography displays
[8318-08]
K. Abhari, Robarts Research Institute (Canada) and The Univ. of Western Ontario (Canada); J. S. H. Baxter, Robarts Research Institute (Canada); R. Eagleson, T. Peters, Robarts Research Institute (Canada) and The Univ. of Western Ontario (Canada); S. de Ribaupierre, The Univ. of Western Ontario (Canada)

8318 0B Radiologists’ eye gaze when reading cranial CT images [8318-10]
A. Venjakob, Technische Univ. Berlin (Germany); T. Marnitz, Charité Universitätsmedizin Berlin (Germany); J. Mahler, S. Sechelmann, M. Roetting, Technische Univ. Berlin (Germany)

8318 0C iPads and LCDs show similar performance in the detection of pulmonary nodules [8318-11]
M. F. McEntee, The Univ. of Sydney (Australia); J. Lowe, M. L. Butler, Univ. College Dublin (Ireland); M. Pietrzyk, The Univ. of Sydney (Australia); M. G. Evanoff, The American Board of Radiology (United States); J. Ryan, Ziltron Ltd (United States); P. C. Brennan, The Univ. of Sydney (Australia); L. A. Rainford, Univ. College Dublin (Ireland)

ROC ANALYSIS

8318 0D Quantitative evaluation of the memory bias effect in ROC studies with PET/CT [8318-12]
M. Kallergi, Technological Educational Institute of Athens (Greece) and Biomedical Research Foundation, Academy of Athens (Greece); N. Pianou, A. Georgakopoulos, Biomedical Research Foundation, Academy of Athens (Greece); G. Kafiri, S. Pavlou, Endocrine Clinics (Greece); S. Chatziioannou, Biomedical Research Foundation, Academy of Athens (Greece) and Attikon Univ. Hospital, National Kapodistrian Univ. of Athens (Greece)

8318 0E A new parametrization for the three-class ideal observer's decision rule [8318-13]
D. C. Edwards, The Univ. of Chicago (United States)

8318 0F A nonparametric approach to comparing the areas under correlated LROC curves [8318-14]
A. Wunderlich, F. Noo, The Univ. of Utah (United States)

8318 0G Image recognition and consistency of response [8318-15]
T. M. Haygood, The Univ. of Texas M.D. Anderson Cancer Ctr. (United States); J. Ryan, The Univ. of Sydney (Australia); Q. M. A. Liu, R. Bassett, The Univ. of Texas M.D. Anderson Cancer Ctr. (United States); P. C. Brennan, The Univ. of Sydney (Australia)

8318 0H Inverse dependence of search and classification performances in lesion localization tasks [8318-16]
D. P. Chakraborty, H.-J. Yoon, C. Mello-Thoms, Univ. of Pittsburgh (United States)
8318 0I Outlining and categorising mammographic breast density: expert radiologist perception [8318-17]
Y. Li, P. C. Brennan, The Univ. of Sydney (Australia); W. Lee, Cancer Institute NSW (Australia); J. Ryan, The Univ. of Sydney (Australia); J. Cawson, C. Nickson, The Univ. of Melbourne (Australia); W. Reed, M. W. Pietrzyk, D. Al Mousa, E. Ryan, The Univ. of Sydney (Australia)

8318 0J Measurements of the detectability of hepatic hypovascular metastases as a function of retinal eccentricity in CT images [8318-18]
I. Diaz, Ctr. Hospitalier Universitaire Vaudois (Switzerland) and Univ. de Lausanne (Switzerland); M. P. Eckstein, Univ. of California, Santa Barbara (United States); A. Luyet, P. Bize, F. O. Bochud, Ctr. Hospitalier Universitaire Vaudois (Switzerland) and Univ. de Lausanne (Switzerland)

8318 0K Signal-known exactly detection performance in tomosynthesis: does volume visualization help human observers? [8318-19]
I. Reiser, R. M. Nishikawa, The Univ. of Chicago (United States)

8318 0L Satisfaction of search errors detecting subtle fractures diminish in the presence of more serious injuries [8318-20]
K. S. Berbaum, K. M. Schartz, R. T. Caldwell, G. Y. El-Khoury, K. Ohashi, M. Madsen, E. A. Franken, Jr., The Univ. of Iowa Hospitals and Clinics (United States)

8318 0M Predictive modeling of human perception subjectivity: feasibility study of mammographic lesion similarity [8318-21]
S. Xu, Oak Ridge National Lab. (United States); K. Hudson, Y. Bradley, B. J. Daley, K. Frederick-Dyer, The Univ. of Tennessee Medical Ctr. at Knoxville (United States); G. Tourassi, Oak Ridge National Lab. (United States)

DIGITAL PATHOLOGY II: JOINT SESSION WITH CONFERENCES 8314 AND 8315

8318 0O Analysis of slide exploration strategy of cytologists when reading digital slides [8318-23]
L. Pantanowitz, A. Parwani, Univ. of Pittsburgh Medical Ctr. (United States) and Univ. of Pittsburgh (United States); E. Tseytlin, C. Mello-Thoms, Univ. of Pittsburgh (United States)

8318 0P Influence of LCD color reproduction accuracy on observer performance using virtual pathology slides [8318-24]
E. A. Krupinski, The Univ. of Arizona (United States); L. D. Silverstein, VCD Sciences, Inc. (United States); S. F. Hashmi, A. R. Graham, R. S. Weinstein, H. Roehrig, The Univ. of Arizona (United States)

8318 0Q Compressing virtual pathology slides: human and model observer evaluation [8318-25]
E. A. Krupinski, The Univ. of Arizona (United States); J. P. Johnson, Siemens Corporate Research (United States); S. Jaw, A. R. Graham, R. S. Weinstein, The Univ. of Arizona (United States)
Creation of an ensemble of simulated cardiac cases and a human observer study: tools for the development of numerical observers for SPECT myocardial perfusion imaging

J. M. O’Connor, P. H. Pretorius, Univ. of Massachusetts Medical School (United States); H. C. Gifford, Univ. of Houston (United States); R. Licho, S. Joffe, M. McGuiness, S. Mehurg, M. Zacharias, Univ. of Massachusetts Medical School (United States); J. G. Brankov, Illinois Institute of Technology (United States)

Volumetric detection tasks with varying complexity: human observer performance

L. Platiša, A. Kumcu, Univ. Gent (Belgium); M. Platiša, TASS N.V. (Belgium); E. Vansteenkiste, Univ. Gent (Belgium); K. Deblaere, Gent Univ. Hospital (Belgium); A. Badano, U.S. Food and Drug Administration (United States); W. Philips, Univ. Gent (Belgium)

Performance characteristics of a visual-search human-model observer with sparse PET image data

H. C. Gifford, Univ. of Houston (United States)

Theoretical performance analysis of multislice channelized Hotelling observers

B. Goossens, L. Platiša, W. Philips, Univ. Gent (Belgium)

Utilizing the Hotelling template as a tool for CT image reconstruction algorithm design

A. A. Sanchez, E. Y. Sidky, X. Pan, The Univ. of Chicago Medical Ctr. (United States)

Diagnostic accuracy of digital mammography versus tomosynthesis: effect of radiologists' experience

F. Zanca, Univ. Hospitals of the UZ Leuven (Belgium); M. Wallis, Cambridge Univ. Hospitals NHS Foundation Trust (United Kingdom) and Cambridge Biomedical Research Ctr. (United Kingdom); E. Moa, Sectra Mamea AB (Sweden); K. Leifland, Capio St. Göran's Hospital (Sweden); M. Danielsson, Sectra Mamea AB (Sweden); R. Oyen, H. Bosmans, Univ. Hospitals of the UZ Leuven (Belgium)

Is diagnostic accuracy for detecting pulmonary nodules in chest CT reduced after a long day of reading?

E. A. Krupinski, The Univ. of Arizona (United States); K. S. Berbaum, R. Caldwell, K. M. Schartz, The Univ. of Iowa (United States)

Indirect detection of pulmonary nodule on low-pass filtered and original x-ray images during limited and unlimited display times

M. W. Pietrzyk, M. McEntee, The Univ. of Sydney (Australia); M. G. Evanoff, The American Board of Radiology (United States); P. C. Brennan, The Univ. of Sydney (Australia)

Are improved rater reliability results associated with faster reaction times after rater training for judgments of laryngeal mucus?

H. S. Bonilha, A. Dawson, K. McGrattan, Medical Univ. of South Carolina (United States)
8318 10  Assessment of change in breast density: reader performance using synthetic mammographic images [8318-35]
S. Astley, C. Swayamprakasam, M. Berks, J. Sergeant, The Univ. of Manchester (United Kingdom); J. Morris, M. Wilson, N. Barr, C. Boggis, Univ. Hospital of South Manchester (United Kingdom)

8318 11  Performance differences across the Atlantic when UK and USA radiologists read the same set of test screening cases [8318-36]
Y. Chen, A. G. Gale, Loughborough Univ. (United Kingdom); M. Evanoff, The American Board of Radiology (United States)

POSTER SESSION

8318 12  Dose-optimized slice thickness for routine multislice computed tomography liver examinations [8318-37]
K. Dobeli, The Univ. of Sydney (Australia) and Royal Brisbane and Women's Hospital (Australia); S. Lewis, S. Meikle, The Univ. of Sydney (Australia); D. Thiele, Queensland Health (Australia); P. C. Brennan, The Univ. of Sydney (Australia)

8318 13  Collaborative labeling of malignant glioma with WebMILL: a first look [8318-38]
E. Singh, A. J. Asman, Z. Xu, L. Chambless, R. Thompson, Vanderbilt Univ. (United States); B. A. Landman, Vanderbilt Univ. (United States) and Johns Hopkins Univ. (United States)

8318 14  Subjective evaluation of user experience in interactive 3D visualization in a medical context [8318-39]
S. Tourancheau, M. Sjöström, R. Olsson, Mid Sweden Univ. (Sweden); A. Persson, Univ. Linköping (Sweden); T. Ericson, Setred AB (Sweden); J. Rudling, Univ. Linköping (Sweden); B. Norén, Univ. Hospital Linköping (Sweden)

8318 15  Implementation of combined SVM-algorithm and computer-aided perception feedback for pulmonary nodule detection [8318-40]
M. W. Pietrzyk, The Univ. of Sydney (Australia); D. Rannou, The Univ. of Sydney (Australia) and Institut Superieur de l'Electronique et du Numerique (France); P. C. Brennan, The Univ. of Sydney (Australia)

8318 16  Effect of morphing between unenhanced and multiscale enhanced chest radiographs on pulmonary nodule detection [8318-41]
M. W. Pietrzyk, The Univ. of Sydney (Australia); F. Zöhrer The Univ. of Texas M.D. Anderson Cancer Ctr. (United States); M. T. Harz, Fraunhofer MEVIS (Germany); M. McEntee, The Univ. of Sydney (Australia); H. K. Hahn, Fraunhofer MEVIS (Germany); T. Haygood, The Univ. of Texas M.D. Anderson Cancer Ctr. (United States); M. G. Evanoff, The American Board of Radiology (United States); P. C. Brennan, The Univ. of Sydney (Australia)

8318 17  Effect of selective suppression of spatial frequency domain noise on visual detection of a sample object in an inhomogeneous background [8318-42]
M. W. Pietrzyk, The Univ. of Sydney (Australia); J. S. McDonald, The Univ. of New South Wales (Australia); P. C. Brennan, R. M. Bourne, The Univ. of Sydney (Australia)
Comparison of 2D versus 3D mammography with screening cases: an observer study [8318-43]
J. R. Fernandez, The Univ. of Southern California (United States); R. Deshpande, Image Processing and Informatics Lab., The Univ. of Southern California (United States); L. Hovanessian-Larsen, The Univ. of Southern California (United States); B. Liu, Image Processing and Informatics Lab., The Univ. of Southern California (United States)

A potential method to identify poor breast screening performance (Cum Laude Poster Award) [8318-44]
L. Dong, Y. Chen, A. G. Gale, Loughborough Univ. (United Kingdom); D. P. Chakraborty, Univ. of Pittsburgh (United States)

Does the thinking aloud condition affect the search for pulmonary nodules? [8318-45]
S. Littlefair, P. Brennan, W. Reed, M. Williams, M. W. Pietrzyk, The Univ. of Sydney (Australia)

Effect of lesion blurring on observer performance in AFC experiments using chest CT images [8318-46]
K. M. Ogden, D. Williams, D. Jalloh, M. Roskopf, SUNY Upstate Medical Univ. (United States)

A feasibility assessment of automated FISH image and signal analysis to assist cervical cancer detection [8318-47]
X. Wang, Univ. of Pittsburgh (United States); Y. Li, H. Liu, The Univ. of Oklahoma (United States); S. Li, R. R. Zhang, The Univ. of Oklahoma Health Sciences Ctr. (United States); B. Zheng, Univ. of Pittsburgh (United States)

Assembly and evaluation of a training module and dataset with feedback for improved interpretation of digital breast tomosynthesis examinations [8318-48]
D. Gur, Univ. of Pittsburgh (United States); M. L. Zuley, J. H. Sumkin, C. M. Hakim, D. M. Chough, L. Lovy, C. Sobran, Magee-Womens Hospital (United States); D. Logue, B. Zheng, A. H. Klym, Univ. of Pittsburgh (United States)

Assessment of two mammographic density related features in predicting near-term breast cancer risk [8318-49]

Evaluation of low contrast detectability performance using two-alternative forced choice method on computed tomography dose reduction algorithms [8318-50]
J. Fan, P. Madhav, P. Sainath, X. Cao, H. Wu, R. Nilsen, A. Budde, G. Yadava, J.-B. Thibault, J. Hsieh, GE Healthcare (United States)

Classification of thyroid nodules using a resonance-frequency-based electrical impedance spectroscopy: progress assessment [8318-51]
B. Zheng, M. E. Tublin, D. Lederman, A. H. Klym, E. D. Brown, D. Gur, Univ. of Pittsburgh (United States)

Registration of T2-weighted and diffusion-weighted MR images of the prostate: comparison between manual and landmark-based methods [8318-52]
Y. Peng, Y. Jiang, F. N. Soylu, M. Tomek, W. Sensakovic, A. Oto, The Univ. of Chicago (United States)
A systematic review of automated melanoma detection in dermatoscopic images and its ground truth data [8318-54]
A.-R. A. Ali, T. M. Deserno, RWTH Aachen (Germany)

User-friendly tools on handheld devices for observer performance study [8318-55]
T. Matsumoto, T. Hara, Gifu Univ. Graduate School of Medicine (Japan); J. Shiraishi, Kumamoto Univ. (Japan); D. Fukuoka, Gifu Univ. (Japan); H. Abe, The Univ. of Chicago (United States); M. Matusako, St. Luke’s International Hospital (Japan); A. Yamada, Shinshu Univ. School of Medicine (Japan); X. Zhou, H. Fujita, Gifu Univ. Graduate School of Medicine (Japan)

Studying the relative impact of ghosting and noise on the perceived quality of MR images [8318-56]
H. Liu, Technische Univ. Delft (Netherlands); J. Koonen, M. Fuderer, Philips Medical Systems International B.V. (Netherlands); I. Heynderickx, Technische Univ. Delft (Netherlands) and Philips Research Nederland B.V. (Netherlands)

Combined collimator/reconstruction optimization for myocardial perfusion SPECT imaging using polar map-based LROC numerical observer [8318-57]
S. Konate, P. H. Pretorius, H. C. Gifford, J. M. O'Connor, A. Konik, M. S. Shazeeb, M. A. King, Univ. of Massachusetts Medical School (United States)

Characterizing atherosclerotic plaque with computed tomography: a contrast-detail study [8318-58]
N. Kasraie, G. D. Clarke, The Univ. of Texas Health Science Ctr. at San Antonio (United States)

Quantifying effects of post-processing with visual grading regression [8318-59]
Ö. Smedby, M. Fredrikson, J. De Geer, M. Sandborg, Linköping Univ. (Sweden)

The effect of compression on confidence during the detection of skull fractures in CT [8318-60]
I. Nikolovski, Royal North Shore Hospital (Australia); M. F. McEntee, R. Bourne, M. W. Pietryk, The Univ. of Sydney (Australia); M. G. Evanoff, The American Board of Radiology (United States); P. C. Brennan, The Univ. of Sydney (Australia); K. Tay, I-MED Network (Australia)

3D brain MR angiography displayed by a multi-autostereoscopic screen [8318-61]
D. S. F. Magalhães, F. H. Ribeiro, F. O. Lima, Univ. Estadual de Campinas (Brazil); R. L. Serra, A. B. Moreno, Instituto Superior Politécnico José Antonio Echeverria (Cuba); L. M. Li, Univ. Estadual de Campinas (Brazil)

NPS assessment of color medical displays using a monochromatic CCD camera [8318-62]
H. Roehrig, The Univ. of Arizona (United States) and Image Quality, LLC (United States); X. Gu, Image Quality, LLC (United States); J. Fan, GE Healthcare (United States)

Theoretical demonstration of image characteristics and image formation process depending on image displaying conditions on liquid crystal display [8318-63]
A. Yamazaki, Osaka General Medical Ctr. (Japan) and Graduate School of Medical Sciences, Nagoya Univ. (Japan); K. Ichikawa, Kanazawa Univ. (Japan); M. Funahashi, Osaka General Medical Ctr. (Japan); Y. Kodera, Graduate School of Medical Sciences, Nagoya Univ. (Japan)
Preliminary display comparison for dental diagnostic applications [8318-64]
N. Odlum, G. Spalla, Barco N.V. (Belgium); N. van Assche, B. Vandenberghe, R. Jacobs, M. Quirynen, UZ Leuven (Belgium); C. Marchessoux, Barco N.V. (Belgium)

Impact of solid-state lighting on observer performance of color discrimination [8318-65]
W.-C. Cheng, W. Tannous, A. Badano, U.S. Food and Drug Administration (United States)

Using connectionist models to determine decision making strategy of pathology residents reading dermatopathology digital slides [8318-66]
C. Mello-Thoms, G. Gardner, Univ. of Pittsburgh (United States)

Author Index
Conference Committee

Symposium Chairs

Joseph M. Reinhardt, The University of Iowa (United States)
Nico Karssemeijer, Radboud University Nijmegen Medical Center (Netherlands)

Conference Chairs

Craig K. Abbey, University of California, Santa Barbara (United States)
Claudia R. Mello-Thoms, University of Pittsburgh Cancer Institute (United States)

Program Committee

François Bochud, Centre Hospitalier Universitaire Vaudois (Switzerland)
Jovan G. Brankov, Illinois Institute of Technology (United States)
Darrin C. Edwards, The University of Chicago Medical Center (United States)
Alastair G. Gale, Loughborough University (United Kingdom)
Howard C. Gifford, University of Massachusetts Medical School (United States)
Stephen L. Hillis, Iowa City VA Medical Center (United States)
Elizabeth A. Krupinski, The University of Arizona (United States)
Matthew A. Kupinski, College of Optical Sciences, The University of Arizona (United States)
Anthony J. Maeder, University of Western Sydney (Australia)
David J. Manning, Lancaster University (United Kingdom)
Mark F. McEntee, The University of Sydney (Australia)
Berkman Sahiner, U.S. Food and Drug Administration (United States)
David L. Wilson, Case Western Reserve University (United States)
Federica Zanca, UZ Leuven (Belgium)

Session Chairs

1 Technology Assessment
   Howard C. Gifford, University of Massachusetts Medical School (United States)

2 Image Display
   Mark F. McEntee, The University of Sydney (Australia)

3 ROC Analysis
   Stephen L. Hillis, Iowa City VA Medical Center (United States)
4 Image Perception
David J. Manning, Lancaster University (United Kingdom)

5 Digital Pathology I: Joint Session with Conferences 8314 and 8315
Metin N. Gurcan, The Ohio State University Medical Center (United States)
Anant Madabhushi, Rutgers, The State University of New Jersey (United States)

6 Digital Pathology II: Joint Session with Conferences 8314 and 8315
Metin N. Gurcan, The Ohio State University Medical Center (United States)
Anant Madabhushi, Rutgers, The State University of New Jersey (United States)

7 Model Observers
Matthew A. Kupinski, College of Optical Sciences, The University of Arizona (United States)

8 Observer Performance
Elizabeth A. Krupinski, The University of Arizona (United States)
Fortieth Anniversary of SPIE Medical Imaging Meeting

Robert M. Nishikawa*
Carl J. Vyborny Translation Laboratory for Breast Imaging Research
Department of Radiology, and the Committee on Medical Physics, The University of Chicago, 5841 S. Maryland Ave. MC-2026, Chicago, IL 60637

This meeting marked the 40th year from the first SPIE Medical Imaging meeting. This paper presents a brief summary of the 40-year history of the meeting, with an emphasis on the Physics Conference. That is, when the meeting split into multiple conferences, data are presented mostly for the Physics conference only.

The first conference was held in 1972 in Chicago and it was called: Application of Optical Instrumentation in Medicine.

“We have endeavored, by way of the seminar, to provide a communication link between those with expertise in the various technologies associated with image forming devices and those in the medical field who rely on the fruits of these technologies for many of their diagnostic tools...there is a genuine interest among those in the medical field for a better understanding of the fundamental technology of imaging systems.” William C. Zarnstroff, General Chairman

For the next 40 years, with the exception of 1978 the meeting was held annually.

The first 13 conferences were entitled: Application of Optical Instrumentation in Medicine, appended with a roman numeral. The 14th meeting (1986) was modified to recognize the growing importance of PACS to the meeting: Application of Optical Instrumentation in Medicine XIV and Picture Archiving and Communication Systems (PACS IV) for Medical Applications. The following year, the conference name changed to “Medical Imaging” as it is known today, although the first 6 were denoted by roman numerals. Starting in 1993, the year was appended to the title.

The meeting started as a single track, two-day conference, and now has 8 distinct conferences covering five days plus an additional day of courses.

In 1988, the proceedings were published in two volumes, 914A and 914B. The former covering physics, image processing, and perception and the latter display and PACS. The following year (1989) each of those two split in two so that there were now four conferences:

1. Medical Imaging III: Image Formation
2. Medical Imaging III: Image Capture and Display
3. Medical Imaging III: Image Processing
4. Medical Imaging III: PACS System Design and Evaluation

These sessions were partially overlapping and, thus, for the first time, the meeting had parallel session.

This configuration of conferences remained until 1994 when Image Perception and Physiology and Function from Multidimensional Images were added. In 1997, Ultrasonic Transducer Engineering was added. In 2007, Computer-Aided Diagnosis was added.

From 1976 to 1983, the meeting was held in conjunction with or preceding the American Roentgen Ray Society. As a result, the location of the meeting changed annually. Starting in 1985, the meeting was held in Newport Beach, CA, and this was home for the next 10 years, except in 1991, the meeting was held in San Jose in conjunction with the Electronic Imaging meeting. In 1995, the meeting was then moved to San Diego, and then returned once more to Newport Beach, before moving to San Diego till 2009. Since 2009 the meeting has been alternating between San Diego and Lake Buena Vista, FL.

In the Introduction to the proceedings in 1984, Chairman Roger Schneider wrote:

This meeting, the twelfth in the series ... was intended to be a change in direction from recent meetings in the series, a reversion to the attack on fundamental problems in imaging which earlier meetings represented. We also desired to bring onto the floor a recognition that the scientific interest in imaging

* r-nishikawa@uchicago.edu| phone: 1-773-702-9047
is more broad and active now than it was a decade ago and that substantial progress has been made in formulating at least the structure of an understanding of the conveyance of information to human observers through imaging channels. ... We recognized the current intense interest in development of medical systems based upon the most contemporary image communication and storage technologies, and included that topic. The design goal was to address the physics and statistics of image encoding by modality; and the processing, display, archiving, management, and psychophysical considerations independently of modality, as far as possible.

It took 2 years for this new emphasis to flourish. Beginning in 1986, the attendance and the number of papers increased rapidly (as can be seen in the plots below).

Finally, it is important to note that every year for the past 40 years, the Center for Devices and Radiological Health, FDA (formerly, the Bureau for Radiological Health) has been a cosponsor or supporting organization. Further, many members of the CDRH/BRH have helped organize the meeting, such as Robert Wagner, Robert Jennings, Roger Schneider, David Brown and several others. Their contributions to this meeting mirror the impact that the CDRH/BRH have had on the field.

![Attendance and Total Number of Papers](images/attendance.png)

![Proceedings Volume Number and # of Conferences](images/proceedings.png)

Figure 1. These plots capture some of the statistics from the meeting over time.

1.1 Fun Facts

Bob Wagner dubbed 1984-1987, the Palindrome Years.

The first digital mammography paper and the first dual-energy mammography paper were presented in 1983.

The first computer-aided diagnosis (CAD) paper was presented in 1985.

The first Proceedings (Vol. 35) had a black cover and was hard bound. All subsequent Proceedings had a yellow cover and were soft bound.

The first posters were in 1988. Each poster had 3 full poster boards and wine was served at the poster session.
Although there was no “Medical Imaging” meeting in 1978, there was another medical imaging themed conference: Recent and Future Developments in Medical Imaging I; edited by Norman A. Baily.

In 2001, the proceedings were distributed on CD for the first time.

Table 1. Number of years serving as a Conference Chair (includes all Conferences) or serving on the Physics Committee (including being Chair). Years on Physics Committee includes committee membership when there was only a single conference and only the Physics Committee when there were multiple conferences.

<table>
<thead>
<tr>
<th>Years Served as a Conference Chair</th>
<th>Years Served on Physics Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samuel J. Dwyer III</td>
<td>Robert F. Wagner</td>
</tr>
<tr>
<td>Roger H. Schneider</td>
<td>Hans Roehrig</td>
</tr>
<tr>
<td>R. Gilbert Jost</td>
<td>Martin J. Yaffe</td>
</tr>
<tr>
<td>Yongmin Kim</td>
<td>Robert J. Jennings</td>
</tr>
<tr>
<td>William R. Hendee</td>
<td>Harrison H. Barrett</td>
</tr>
<tr>
<td>Anne V. Clough</td>
<td>Arthur E. Burgess</td>
</tr>
<tr>
<td>Murray H. Loew</td>
<td>James T. Dobbins III</td>
</tr>
<tr>
<td>Joel E. Gray</td>
<td>John M. Boone</td>
</tr>
<tr>
<td>Kenneth M. Hanson</td>
<td>Richard L. Van Metter</td>
</tr>
<tr>
<td>Steven C. Horii</td>
<td>Rodney Shaw</td>
</tr>
<tr>
<td>Arthur G. Haus</td>
<td>Roger H. Schneider</td>
</tr>
<tr>
<td>Elizabeth A. Krupinski</td>
<td>John Yorkston</td>
</tr>
<tr>
<td>Eric A. Hoffman</td>
<td>Kunio Doi</td>
</tr>
<tr>
<td>Harold L. Kundel</td>
<td>Larry E. Antonuk</td>
</tr>
<tr>
<td>K. Kirk Shung</td>
<td>Stephen W. Smith</td>
</tr>
<tr>
<td>Seong K. Mun</td>
<td>Bruce R. Whiting</td>
</tr>
<tr>
<td>William F. Walker</td>
<td>Jacob Beutel</td>
</tr>
<tr>
<td></td>
<td>Arthur G. Haus</td>
</tr>
<tr>
<td></td>
<td>Ian A. Cunningham</td>
</tr>
<tr>
<td></td>
<td>John A. Rowlands</td>
</tr>
<tr>
<td></td>
<td>Judith M. S. Prewitt</td>
</tr>
<tr>
<td></td>
<td>Kenneth M. Hanson</td>
</tr>
<tr>
<td></td>
<td>Michael J. Flynn</td>
</tr>
<tr>
<td></td>
<td>Murray H. Loew</td>
</tr>
<tr>
<td></td>
<td>Robert A. Kruger</td>
</tr>
<tr>
<td></td>
<td>Robert M. Nishikawa</td>
</tr>
<tr>
<td></td>
<td>Samuel J. Dwyer III</td>
</tr>
<tr>
<td></td>
<td>Stephen R. Thomas</td>
</tr>
<tr>
<td></td>
<td>Steven C. Horii</td>
</tr>
<tr>
<td></td>
<td>Thomas G. Flohr</td>
</tr>
</tbody>
</table>

1.2 Summary of Each Meeting

Following is a brief summary of each meeting from 1972-2012. When there were multiple conferences at the meeting, the summary focuses mainly on the Physics Conference. I also have most of this information in an excel spreadsheet. It is available from the author to those who would like it.
Overview of the 40-Year History of the SPIE Medical Imaging Meeting

1972
Application of Optical Instrumentation in Medicine (In-depth-Seminar)
Chicago Nov 29-30
Vol. 35 29 papers Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, BRH, ASNR, SMM, UWMS; AAPM
Chairs
William Zamanoff, William R. Hendee, Paul L. Carson
Program Committee
Not listed
Sessions
Electro-Optical Instrumentation - William R. Hendee
Image Analysis, Enhancement and Evaluation - Paul L. Carson
Holographic and Video Images - William R. Hendee
Special Topics - William C. Zamanoff
Panel Discussion - Jack G. Kroemer

1973
Application of Optical Instrumentation in Medicine II
Chicago Nov 29-30
Vol. 43 35 papers Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, AAPM, ASNR, AAMI, BRH, EMBG, OSA, SMM, SRE, SPIE;
Chairs
William R. Hendee, William C. Zamanoff, Paul L. Carson
Program Committee
Not listed
Sessions
Nuclear Medicine Imaging
Image Enhancement and Pattern Recognition
Panel Discussion: Image Enhancement for Medical Diagnosis Can It Be Effective?
Special Topics
Image Intensifier Systems
Transmission, Storage, Retrieval and Reconstruction of Images
Panel Discussion: Performance Standards and Possible Field Evaluation of Image Intensifiers Performance Standards of Image Intensifiers

1974
Application of Optical Instrumentation in Medicine III
Kansas City, MO Aug 1-2
Vol. 47 45 papers Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, BRH, AAPM, ARRS, EMBG
Chairs
Paul L. Carson, Edward L. Chaney, William R. Hendee
Program Committee
Not listed
Sessions
Transmission, 3-Dimensional Image Reconstruction and Computerized Axial Tomography - William R. Hendee, Joseph Gallagher
Advanced Techniques in Imaging With Ultrasound - Paul L. Carson
Acoustic Exposure Determination in Diagnostic Ultrasound - James A. Rooney
Noise, Objective, and Psychophysical Measures - Joel E. Gray
Special Topics - Jacques Ovadia
Ray Tube Focal Spot Size and Intensity Distributions: Important Practical Considerations - Sergi E. Bjarring
Automatic Brightness Control in Image-Intensified Fluoroscopy - William R. Hendee

1975
Application of Optical Instrumentation in Medicine IV
Atlanta, GA Sept. 25-27
Vol. 70 55 papers Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, BRH, AAPM, ARRS, ACR, SRE
Chairs
Joel E. Gray, William R. Hendee
Program Committee
Not listed
Sessions
Quality Assurance, Film Handling & Film Processing - Joel E. Gray
Loading, Heat Rating, Other Characteristics of X-Ray Tubes - Edward L. Chaney
Information Extraction & Utilization From Radiologic Images - Marvin E. Haaskin
Quality Assurance In Diagnostic Radiology: Why Doesn't Every Department Have A Complete Program? Panel Discussion
Quality Assurance for Diagnostic Radiologic Instrumentation - James J. Vucicf
Exposure Initiation/Termination Mechanisms and Automatic Exposure Timers In Diagnostic Radiology - Robert G. Wagner
Rare Earth Intensifying Screens - E. Dale Trout
Panel Discussion: Performance Specifications for Diagnostic Radiologic Equipment - Gray-Scale Ultrasound Imaging & Tissue Identification - Paul L. Carson
Physical Evaluation of Computerized Axial Tomography - Raymond P. Rossi
Special Topics - Robert Rohrer
Performance Evaluation of Mammographic Imaging Systems - Gregory L. Dubasque
1976
Application of Optical Instrumentation in Medicine V
Washington, DC Sept. 15-19
Vol. 96 76 papers Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, BRH, ARRS, SRE
Chairs
Program Committee
Same as Editors
Sessions
Quality Assurance in Diagnostic Radiology I - Raymond F. Rossi
Quality Assurance in Diagnostic Radiology II - Thomas Stone
Computed Tomography I - Norman A. Baily
Radiographic Images and Dose - Arthur G. Haus
Computed Tomography II - Rodney A. Brooks
Computed Tomography III - Kenneth Weiner
Diagnostic Ultrasound I - Paul L. Canion
Quality Assurance in Diagnostic Radiology III - Robert K. Carak
Current Topics in Mammography - Gregory Dubuque

1977
Application of Optical Instrumentation in Medicine VI
Bretton, MA Sept. 25-27
Vol. 127 80 papers Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, BRH, ARRS, SRE
Chairs
Joel E. Gray, William R. Hendee
Program Committee
Sessions
The Laboratory/Clinical Interface in Image Evaluation - Robert Wagner
Sensitometry: Up-Date - Joel Gray
Screen Film Systems and Photograph Materials - Arthur G. Haus
Approaches to Equipment Service, Equipment Specification and Performance Evaluation - Raymond P. Rossi
New Developments in Medical Imaging - William Hendee
Quality Control in Medical Imaging - William S. Properzio
Performance Characteristics of CT Scanners - Robert K. Carak
Small Group Sessions on Special Topics - Joint Session with ARRS

1978
No Meeting

1979
Application of Optical Instrumentation in Medicine VII
Toronto, Canada Mar. 25-27
Vol. 173 55 papers Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, SPIE, ARRS, BRH, SRE
Chairs
Joel E. Gray
Program Committee
Sessions
Imaging Systems: Physical Evaluation - Joel Gray
Imaging Systems: Perception Evaluation - Joel Gray
Imaging Systems: Special Topics - Arthur Haus
Mammography - William Properzio
Special Topics - Raymond Rossi
Computed Tomography: Practical Considerations - William R. Hendee
Computed Tomography: Theoretical Considerations - William R. Hendee
X-Ray Imaging Research in Toronto - K. W. Taylor
Joint Session with the ARRS - Joel Gray, William R. Hendee, Harry Z. Melrose
1980
Application of Optical Instrumentation in Medicine VIII
Las Vegas, NV  Apr 20-22
Vol. 233  43 papers  Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE; SPSE; ARRS; BRH; SPIE
Chairs
Joel Gray, Arthur G. Haus, William R. Hendee, William S. Properzio
Program Committee
Same as Editors

1981
Application of Optical Instrumentation in Medicine IX
San Francisco, CA  Mar 22-24
Vol. 273  51 papers  Attendance: n/a
Sponsors, Co-Sponsors & Supporting Organizations
SPIE; SPSE; AAPM; ARRS; BRH; SPIE
Chairs
Joel E. Gray, Arthur G. Haus, William S. Properzio, James A. Mulvaney
Program Committee
Same as Editors

1982
Application of Optical Instrumentation in Medicine X
New Orleans  May 9-12
Vol. 347  59 papers  Attendance: 300
Sponsors, Co-Sponsors & Supporting Organizations
SPIE; ARRS; AAPM; BRH; SPIE; SPIE
Chairs
Gary D. Fullerton, Arthur G. Haus, William S. Properzio, James A. Mulvaney
Program Committee
Same as Editors

1983
Application of Optical Instrumentation in Medicine XI
Atlanta  Apr 17-23
Vol. 419  41 papers  Attendance: 296
Sponsors, Co-Sponsors & Supporting Organizations
SPIE; ARRS; AAPM; BRH; SPIE; SPIE
Chairs
Gary D. Fullerton
Program Committee
Arthur G. Haus, James A. Mulvaney, William Properzio

Sessions
Advances in Broad Imaging - Roger S. Powell
Conventional Imaging Systems Evaluation - Arthur G. Haus
Digital Radiography - James A. Mulvaney
Image Performance Evaluation and Quality Assurance - William S. Properzio
Digital Radiography II - Stewart C. Bushong
Breakout Session A - Nuclear Magnetic Resonance Imaging - Gary D. Fullerton
Breakout Session B - Digital Radiography - William S. Properzio
Breakout Session C - Conventional Imaging - James A. Mulvaney
Joint Session with SPIE and The ARRIS - Marin M. Fidgey; Gary D. Fullerton
New Modalities and Computers in Medical Imaging - Michael J. Flynn

Integrated Systems for Analysis and Display of Radiological Images - Michael J. Flynn
Nuclear Magnetic Resonance (NMR) (Coprisoned by ARRS and SPIE) - A. Evete F.
Janes, Raymond L. Nomally
Nuclear Magnetic Resonance (NMR) (Coprisoned by ARRS and SPIE) - A. Evete F.
Janes, Raymond L. Nomally
Computerized Tomography - Gary D. Fullerton
Recording, Storage, and Processing of Images - Joel E. Gray
2000

Medical Imaging 2000: Physics of Medical Imaging
San Diego, CA  Feb 13-15
Vol. 3957  493 papers  (71 in Physics)  Attendance: 1052

Sponsors, Co-Sponsors & Supporting Organizations
SPIE; AAPM; APS; CDRH; EMBS; IS&T; NEMA; RSNA; SCAR

Chairs
James T. Dobbins III; John M. Boone

Program Committee
Larry E. Antonuk; Jacob Beutel; Ian A. Cunningham; Frank A. D’Allano;
Gary S. Kayes; Andrew D. A. Maidment; Robert A. Street; Robert F. Wagner;
Martin J. Yaffe

X-ray Detectors I - John M. Boone
Imaging Physics - Gary S. Kayes
Fluoroscopic Imaging - Robert A. Street
Mammography I - Martin J. Yaffe
Microscopy - James T. Dobbins III
Mammography II - Andrew D. A. Maidment
Computed Tomography and MRI - Frank A. DiBianca
New Frontiers - Jacob Beutel
Volume Imaging - Ian A. Cunningham
X-ray Detectors II - Larry E. Antonuk
Optimization of Image Quality - Robert F. Wagner

Other Conferences
Vol #  Title                          Editor/Conference Chair   papers
3956  Image Display and Visualization  Seong K. Mun                      62
3978  Physiology and Function from Multi-dimensional Images  Chiu-Tsu Chen, Anne V. Clough  57
3979  Image Processing  Kenneth H. Hanson                           166
3980  PACS Design and Evaluation: Engineering and Clinical Issues  G. James Blaine, Elrod L. Siegel  50
3981  Image Perception and Performance  Elizabeth A. Kupinski                36
3982  Ultrasonic Imaging & Signal Processing  K. Kirk Shung, Michael F. Insana  46

2001

Medical Imaging 2001: Physics of Medical Imaging
San Diego, CA  Feb 17-23
Vol. 4520  802 papers  (103 in Physics)  Attendance: 1195

Sponsors, Co-Sponsors & Supporting Organizations
SPIE; AAPM; APS; CDRH; IS&T; NEMA; RSNA; SCAR

Chairs
Larry E. Antonuk; Martin J. Yaffe

Program Committee
Katharine P. Andriele; Tom J. Bruijns; Ian A. Cunningham;
James T. Dobbins III; Michael J. Flynn; Andrew D. Maidment;
Robert A. Street; Robert F. Wagner; John Yorkston

Sessions
X-ray Detectors I - Larry E. Antonuk
Imaging Physics I - Ian A. Cunningham
Fluoroscopic Imaging - Katherine P. Andriele
Mammography I - Andrew D. Maidment
X-ray Detectors II - Robert A. Street
CT/MD - Michael J. Flynn
Novel Imaging Methods I - James T. Dobbins III
Image Physics III - Martin J. Yaffe
Volume Imaging - Tom J. Bruijns
Novel Imaging Methods II - John Yorkston
X-ray Detectors III - Robert F. Wagner

Other Conferences
Vol #  Title                          Editor/Conference Chair   papers
4319  Visualization, Display, and Image-Quality Procedures  Seong K. Mun                      83
4321  Physiology and Function from Multidimensional Images  Chiu-Tsu Chen, Anne V. Clough  62
4322  Image Processing  Milan Sonka, Kenneth H. Hanson                           209
4323  PACS and Integrated Medical Information Systems: Design & Evaluation  Elrod L. Siegel, H. K. Huang  56
4324  Image Perception and Performance  E.A. Kupinski, Dev P. Chakraborty                31
4325  Ultrasonic Imaging & Signal Processing  Michael F. Insana, K. Kirk Shung               58

2002

Medical Imaging 2002: Physics of Medical Imaging
San Diego, CA  23 – 28 February
Vol. 4682  564 papers  (90 in Physics)  Attendance: 1142

Sponsors, Co-Sponsors & Supporting Organizations
SPIE; AAPM; APS; CDRH; IS&T; NEMA; RSNA; SCAR

Chairs
Larry E. Antonuk; Martin J. Yaffe

Program Committee
Katherine P. Andriele; John M. Boone; Tom J. Bruijns; Michael J. Flynn;
Paul R. Granford; Andrew D. Maidment; Robert A. Street; John Yorkston; Wei Zhao

Sessions
X-Ray Detectors I - Imaging Physics
Volume Imaging I - Breast Imaging
Volume Imaging II - Novel Imaging Methods I
Fluoroscopy/Real Time - Volume Imaging III
X-Ray Detectors II - X-Ray Detectors III - Imaging Physics II
Novel Imaging Methods II - Poster Session

Other Conferences
Vol #  Title                          Editor/Conference Chair   papers
4681  Visualization, Image-Guided Procedures, and Display  Seong K. Mun                      82
4683  Physiology and Function from Multidimensional Images  Anne V. Clough, Chiu-Tsu Chen  63
4684  Image Processing  Milan Sonka, J. Michael Fitzpatrick                186
4685  PACS and Integrated Medical Information Systems: Design & Evaluation  Elrod L. Siegel, H. K. Huang  58
4686  Image Perception, Observer Performance, and Technology Assessment  Dev P. Chakraborty, Elizabeth A. Kupinski  40
4687  Ultrasonic Imaging and Signal Processing  Michael F. Insana, William F. Walker               47

2003

Medical Imaging 2003: Physics of Medical Imaging
San Diego, CA  Feb 15-20
Vol. 5630  636 papers  (108 in Physics)  Attendance: 1073

Sponsors, Co-Sponsors & Supporting Organizations
SPIE; AAPM; APS; CDRH; IS&T; NEMA; RSNA; SCAR

Chairs
Martin J. Yaffe; Larry E. Antonuk

Program Committee
Katherine P. Andriele; Harrison H. Barnett; John M. Boone; Tom J. C. Bruijns;
James T. Dobbins III; Michael J. Flynn; Paul R. Granford; John Yorkston; Wei Zhao

Sessions
Imaging Physics I - John M. Boone
X-Ray Detectors I - Larry E. Antonuk
CT - Paul R. Granford
Breast Imaging I - Martin J. Yaffe
X-Ray Detectors II - Wei Zhao
Novel Imaging Methods - Harrison H. Barnett
Breast Imaging II - John Yorkston
Volume Imaging - US/Tomosynthesis - Michael J. Flynn
Imaging Physics III - James T. Dobbins III
X-Ray Detectors III - Tom J. C. Bruijns
Breast Imaging III - Larry E. Antonuk

Other Conferences
Vol #  Title                          Editor/Conference Chair   papers
5621  Visualization, Image-Guided Procedures, and Display  Robert L. Galewsky, Jr.                      88
5623  Physiology and Function Methods, Systems, and Applications  Anne V. Clough, Anil A. Amri  65
5624  Image Processing  Milan Sonka, J. Michael Fitzpatrick                207
5629  PACS and Integrated Medical Information Systems: Design & Evaluation  H. K. Huang, Osman M. Rafa  57
5630  Image Perception, Observer Performance, and Technology Assessment  Dev P. Chakraborty, Elizabeth A. Kupinski  58
5631  Ultrasonic Imaging & Signal Processing  William F. Walker, Michael F. Insana               56
2004
Medical Imaging 2004: Physics of Medical Imaging
San Diego, CA 14 - 19 February
Vol. 5368 853 papers (102 in Physics) Attendance: 1048
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, AAPM, APS, CDHH, IS&T, NEMA, RSNA, SCAR
Chairs
Martin J. Yaffe, Michael J. Flynn
Program Committee
Harrison H. Barrett; Jon M. Boone; Tom J. C. Bruijns; James T. Dobbins III; Paul R. Grantham; John Yorkston; Wei Zhao

Sessions
Imaging Performance - Harrison H. Barrett
Computer Tomography I - Tom J. C. Bruijns
Imaging Systems Analysis I - James T. Dobbins III
Digital Radiography I - John Yorkston
Digital Radiography II - Paul R. Grantham
Optical/US/Acoustic Imaging - Harrison H. Barrett
Micro Tomography - Michael J. Flynn
Computed Tomography II - Jang Hsieh
Digital Radiology II - Wei Zhao
Imaging Systems Analysis II - Michael J. Flynn
Mammography - Martin J. Yaffe

Other Conferences

Vol # Title Editor/Conference Chair # of pages
5367 Visualization, Image-Guided Procedures, and Display Robert L. Galloway, Jr. 92
5369 Physiology, Function, and Structure from Medical Images Amr A. Amri, Armando Manduca 90
5370 Image Processing J. Michael Fitzpatrick, Milan Sonka 232
5371 PACS and Imaging Informatics Osman M. Reisi, H. K. Huang 48
5372 Image Perception, Observer Performance, and Tech Assessment Dev P. Chakrabarty, Miguel P. Eckstein 60
5373 Ultrasonic Imaging and Signal Proc William Walker, Stanislav Emelianov 39

2005
Medical Imaging 2005: Physics of Medical Imaging
San Diego, CA 12-17 February
Vol. 5745 745 papers (144 in Physics) Attendance: 1100
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, AAPM, APS, CDHH, IS&T, NEMA, RSNA, SCAR
Chairs
Michael J. Flynn
Program Committee
Aldo Badano; Harrison H. Barrett; James T. Dobbins III; Jang Hsieh; Bruce R. Whiting; Martin J. Yaffe; John Yorkston; Wei Zhao

Sessions
Keynote Session - Michael J. Flynn
Image Data Analysis - Bruce R. Whiting
Innovative Imaging Methods - Michael J. Flynn
X-ray Computed Tomography - Jang Hsieh
X-ray Imaging Detectors - Wei Zhao
Computational Simulations - Michael J. Flynn
X-ray Computed Tomography - Bruce R. Whiting
X-ray Imaging Detectors - Martin J. Yaffe
Performance Measurement - Aldo Badano
Digital Radiography - John Yorkston
Tomosynthesis and Dual Energy Imaging - James T. Dobbins III

Other Conferences

Vol # Title Editor/Conference Chair # of pages
5744 Visualization, Image-Guided Procedures, and Display Robert L. Galloway, Jr., Kevin R. Cleary
5746 Physiology, Function, and Structure from Medical Images Amr A. Amri, Armando Manduca 99
5747 Image Processing Michael Fitzpatrick, Joe Renhardt 231
5748 PACS and Imaging Informatics Osman M. Reisi, H. K. Huang 53
5749 Image Perception, Observer Performance, and Tech Assessment Dev P. Chakrabarty, Miguel P. Eckstein 50

2006
Medical Imaging 2006: Physics of Medical Imaging
San Diego, CA 11-16 February
Vol. 6142 760 papers (164 in Physics) Attendance: 1169
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, AAPM, APS, CDHH, IS&T, NEMA, RSNA, SCAR
Chairs
Michael J. Flynn, Jang Hsieh
Program Committee
Aldo Badano; Harrison H. Barrett; Jeffrey A. Fessler; Thomas Fich; Robert M. Niskiwaka; Michael Overdick; John A. Rowlands; Ehsan Samei; Richard L. Van Meter; Bruce R. Whiting; Wei Zhao

Sessions
Keynote Session - Michael J. Flynn
Mammography - Robert M. Niskiwaka
Tomosynthesis - Richard L. Van Meter
X-ray CT - cardiac - Jang Hsieh
Optical and MR Imaging - Harrison H. Barrett
X-ray Imaging Detectors I & II - John A. Rowlands; Wei Zhao
X-ray CT - Bruce R. Whiting
Innovative Imaging - Jang Hsieh
X-ray Imaging - Michael Overdick
Dual Energy X-ray Imaging - Michael J. Flynn
Computational Simulation - Aldo Badano
CT and DR Performance Assessment - Ehsan Samei

Other Conferences

Vol # Title Editor/Conference Chair papers
6141 Visualization, Image-Guided Procedures, and Display Kevin Cleary, Robert L. Galloway, Jr. 94
6142 Physiology, Function, and Structure from Medical Images Armando Manduca, Amr A. Amri 231
6143 Image Processing Joseph Renhardt, Jason Plumb 243
6144 PACS and Imaging Informatics Dev P. Chakrabarty, Daniel M. Radd 43
6146 Image Perception, Ofa Perform & Tech Assess Yu-Yun Jiang, Miguel P. Eckstein 44
6147 Ultrasonic Imaging and Signal Processing Stanislav Emelianov, William Walker 55

2007
Medical Imaging 2007: Physics of Medical Imaging
San Diego, CA 17-22 February
Vol. 6510 855 papers (201 in Physics) Attendance: 1278
Sponsors, Co-Sponsors & Supporting Organizations
SPIE, AAPM, APS, IS&T, NEMA, RSNA, SIIM, SNM, DCOM
Chairs
Jang Hsieh, Michael J. Flynn
Program Committee
Aldo Badano; Jeffrey A. Fessler; Thomas Fich; Christoph Hoaschen; Robert M. Niskiwaka; Michael Overdick; John A. Rowlands; Ehsan Samei; Katsuyuki Taguchi; Richard L. Van Meter; Bruce R. Whiting

Sessions
Dual Energy - Richard L. Van Meter
Performance Assessment - John A. Rowlands
Innovative Imaging I & II. Aldo Badano, Michael J. Flynn
Detector Technology - Michael Overdick
System Modeling - Christoph Hoaschen
Cardiac Imaging - Jang Hsieh
X-ray Imaging - Ehsan Samei
Computed Simulation - Thomas Fich
Advanced Reconstruction - Jeffrey A. Fessler

Other Conferences

Vol # Title Editor/Conference Chair papers
6510 Visualization, Image-Guided Procedures Kevin R. Cleary, Michael L. Moga 115
6511 Physiology, Function, & Structure from Med Images Amr A. Amri, Armando Manduca, Joseph Plumb 47
6512 Image Processing Jason Plumb, Joseph Renhardt 243
6513 Ultrasonic Imaging and Signal Processing Stanislav Emelianov, Stephen McKenney 50
6514 Computerized Diagnosis Martin L. Ager, Dieter Margreiter 121
6515 Image Perception, Ofa Perform & Tech Assess Yu-Yun Jiang, Bertman Sahiner 59
6516 PACS and Imaging Informatics Kevin R. Cleary, Katherine P. Andrews 49
2011

Medical Imaging 2011: Physics of Medical Imaging

Lake Buena Vista, FL  13–17 February
Vol. 7961  864 papers (204 in Physics)  Attendance: 1136

Sponsors, Co-Sponsors & Supporting Organizations
SPIE; AAPM; APS; CARS; IS&T MIPS; RSNA; SIIM; SMI; DICOM

Chairs
Norbert J. Pelc, Ehsan Samei, Robert M. Nishikawa

Program Committee
Guang-Hong Chen; Dianna Cody; Mats Danielsson; Maria Drangova; Thomas Flohr; Stephen J. Glick; Michael Grass; Christoph Hoeschen; Marc Kachelriess; Karim S. Karim; Hee-Joung Kim; Despina Kontos; Iacovos Kyprianou; Jinyi Qi; John A. Rowlands; John M. Sabol; Taly Gilat Schmidt; Jeffrey H. Siewerdsen; Katsuyuki Taguchi; Anders Tingberg; Bruce R. Whiting; John Yorkston;

Sessions
Keynote and Imaging and Health Economics - Norbert J. Pelc; Ehsan Samei
X-ray Imaging - John A. Rowlands; Christoph Hoeschen
Metrology - Robert M. Nishikawa; John Yorkston
Iterative and Statistical Reconstruction - Jinyi Qi; Guang-Hong Chen
Detectors I & II- John Yorkston; John A. Rowlands / Karim S. Karim; Mats Danielsson
Breast Imaging - Anders Tingberg; Stephen J. Glick
Tomosynthesis I: Reconstruction - John M. Sabol; Michael Grass
Tomosynthesis II - Despina Kontos; Anders Tingberg
X-ray Imaging: Phase Contrast Diffraction - Jeffrey H. Siewerdsen; Taly Gilat Schmidt
Image Reconstruction - Bruce R. Whiting; Katsuyuki Taguchi
CT III: Multi-energy - Thomas G. Flohr; John M. Sabol
Novel Systems - Mats Danielsson; Taly Gilat Schmidt
CT IV: Cone Beam - Maria Drangova; Marc Kachelriess
Dose - Iacovos S. Kyprianou; Hee-Joung Kim

Two Special Sessions on Dose with a Panel Discussion - Ehsan Samei; Dianna D. Cody / Christoph Hoeschen; Michael F. McNitt-Gray / Ehsan Samei
2012

Medical Imaging 2012: Physics of Medical Imaging

San Diego, CA  Feb 5-9
Vol. 8313   909 papers (233 in Physics)  Attendance: ?

Sponsors, Co-Sponsors & Supporting Organizations
SPIE; AAPM; APS; CARS; MIPS; RSNA; SIIM; SMI; WMIS; DICOM

Chairs
Norbert J. Pelc, Robert M. Nishikawa, Bruce Whiting

Program Committee
Hilde Bosmans; Guang-Hong Chen; Dianna D Cody; Mats E Danielsson; Maria Drangova; Thomas G. Flohr; Stephen J. Glick; Michael Grass; Christoph Hoeschen; Marc Kachelriess; Karim S Karim; Hee-Joung Kim; Despina Kontos; Iacovos S. Kyprianou; Joseph Y Lo; Jinyi Qi; John A Rowlands; John M Sabol; Taly G. Schmidt; Jeffrey H. Siewersden; Anders Tingberg; John Yorkston

Sessions
Keynote and 3D Breast Imaging - Norbert J. Pelc; Robert M. Nishikawa
3D Breast Imaging - Hilde Bosmans; Joseph Y. Lo
Breast Multi-Energy/Photon Counting - Mats E. Danielsson; Stephen J. Glick
Mammography - Anders Tingberg; Despina Kontos
X-Ray Imaging - Hee-Joung Kim; Karim S. Karim
Small Animal Imaging - John Yorkston; Maria Drangova
Photon Counting Systems and Techniques - Taly G. Schmidt; Jeffrey H. Siewersden
General Radiography and Fluoroscopy - John A. Rowlands; Hee-Joung Kim
Cone Beam CT - Iacovos S. Kyprianou; John Yorkston
CT - Dianna D. Cody; Marc Kachelriess
CT Detection Performance - Jinyi Qi; Bruce R. Whiting
Dose - Christoph Hoeschen; Dianna D. Cody
Reconstruction I & II - Guang-Hong Chen; Michael Grass/ Thomas Flohr; Jeff Siewersden
Tomosynthesis Reconstruction - John M. Sabol; Iacovos S. Kyprianou

8314  Image Processing  David R. Haynor, Sebastien Ourselin  185
8315  Computer-Aided Diagnosis  Bram van Ginneken, Carol L. Novak  129
8316  Image-Guided Procedures, Robotic Interventions and Modeling  David R. Holmes III, Kenneth H. Wong  123
8317  Biomedical Applications in Molecular, Structural, and Functional Imaging  Robert C. Mothon, John B. Weaver  78
8318  Image Perception, Observer Performance, and Technology Assessment  Craig K. Abbey, Claudia Molto-Thoms  66
8319  Advanced PACS-based Imaging Informatics and Therapeutic Applications  William W. Boorin, Brent J. Liu  38
8320  Ultrasonic Imaging, Tomography, and Therapy  Johan G. Bosch, Marvin M. Doyley  57

xxvii
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAMI</td>
<td>Association for the Advancement of Medical Instrumentation</td>
</tr>
<tr>
<td>AAPM</td>
<td>American Association of Physicists in Medicine</td>
</tr>
<tr>
<td>ACR</td>
<td>American College of Radiology</td>
</tr>
<tr>
<td>APS</td>
<td>American Physiological Society</td>
</tr>
<tr>
<td>ARRS</td>
<td>American Roentgen Ray Society</td>
</tr>
<tr>
<td>ASNR</td>
<td>American Society of Neuroradiology</td>
</tr>
<tr>
<td>BIOS</td>
<td>Biomedical Optics Society</td>
</tr>
<tr>
<td>BRH</td>
<td>Bureau of Radiological Health, Department of Health, Education And Welfare</td>
</tr>
<tr>
<td>CARS</td>
<td>Computer Assisted Radiology and Surgery</td>
</tr>
<tr>
<td>CDRH</td>
<td>Center for Devices and Radiological Health, FDA</td>
</tr>
<tr>
<td>DICOM</td>
<td>The DICOM Standards Committee</td>
</tr>
<tr>
<td>EFOMP</td>
<td>European Federation of Organizations for Medical Physics</td>
</tr>
<tr>
<td>EMBG</td>
<td>IEEE Engineering in Medicine and Biology Group</td>
</tr>
<tr>
<td>EMBS</td>
<td>IEEE—The Institute of Electrical and Electronics Engineers/Engineering in Medicine and Biology Society</td>
</tr>
<tr>
<td>IEEE-CS</td>
<td>IEEE Computer Society, Technical Committee on Computational Medicine</td>
</tr>
<tr>
<td>IRS</td>
<td>Institute for Regulatory Science</td>
</tr>
<tr>
<td>IS&amp;T</td>
<td>The Society for Imaging Science and Technology</td>
</tr>
<tr>
<td>JPL</td>
<td>Jet Propulsion Laboratory</td>
</tr>
<tr>
<td>MIPS</td>
<td>Medical Image Perception Society</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association/Diagnostic Imaging and Therapy, Systems Division</td>
</tr>
<tr>
<td>OSA</td>
<td>The Optical Society of America</td>
</tr>
<tr>
<td>RISC</td>
<td>Radiology Information System Consortium</td>
</tr>
<tr>
<td>RSNA</td>
<td>Radiological Society of North America</td>
</tr>
<tr>
<td>SCAR</td>
<td>Society for Computer Applications in Radiology</td>
</tr>
<tr>
<td>SIM</td>
<td>Society for Imaging Informatics in Medicine</td>
</tr>
<tr>
<td>SMI</td>
<td>The Society for Molecular Imaging</td>
</tr>
<tr>
<td>SNM</td>
<td>The Society of Nuclear Medicine</td>
</tr>
<tr>
<td>SPIE</td>
<td>The Society of Photo-Optical Instrumentation Engineers</td>
</tr>
<tr>
<td>SPSE</td>
<td>The Society of Photographic Scientists and Engineers</td>
</tr>
<tr>
<td>SRE</td>
<td>Society for Radiological Engineering</td>
</tr>
<tr>
<td>UWMS</td>
<td>University of Wisconsin Medical School</td>
</tr>
<tr>
<td>WMIS</td>
<td>World Molecular Imaging Society</td>
</tr>
</tbody>
</table>
Image Perception at SPIE – Did You See What I Saw?

Elizabeth A. Krupinski
Department of Medical Imaging University of Arizona Tucson, AZ 85724

ABSTRACT

The Image Perception & Performance Conference has not been a track in the SPIE Medical Imaging Meeting for 40 years, but has been an integral part of the meeting since its inception in 1994 in a variety of ways. Everything discussed at the SPIE Medical Imaging meeting, whether overtly discussed or implied, relates back to one fundamental idea – developing better tools for radiologists and other clinicians to render more effective and efficient diagnostic decisions. Thus image perception and observer performance issues are fundamental to the medical imaging field. This poster highlights some of the trends observed since 1994 years at the SPIE Medical Imaging meeting as they relate specifically to the Image Perception & Performance Conference. The Image Perception track has covered a wide variety of areas, including Methods for Assessing Performance, Mathematical Observer Modeling, Human-Computer Interface & Ergonomics, Eye-Tracking & Visual Search, and Clinical Decision Making. Investigation of the perceptual and cognitive factors underlying medical image interpretation is an important and valuable endeavor that contributes significantly to our continuing efforts to improve the detection, diagnosis and treatment of diseases to improve patient care and well-being. Collaborations between medical physicists, workstation design engineers, image processing and image analysis scientists, and vision and cognitive psychologists should be encouraged to facilitate and promote further research in medical image perception so that patient care can be improved.

Keywords: image perception, 40th anniversary

INTRODUCTION

The Image Perception & Performance Conference has not been a track in the SPIE Medical Imaging Meeting for all 40 years, but it has been an integral part of the meeting since its inception in 1994. Initially it was called the “Image Perception” conference. In 1999 the name was changed to “Image Perception and Performance”, and in 2002 it was changed to “Image Perception, Observer Performance, and Technology Assessment” which is its current title. These changes in the title since 1994 reflect not only the growth of the conference and its participants, but also the recognition that perception goes far beyond simply trying to understand the role of the visual system and visual processing in medical image interpretation. In order to fully appreciate and comprehend the interpretation process, observer performance (what decisions are rendered, the accuracy of those decisions, the efficiency with which they are made etc.) must also be taken into account. Additionally, the technology involved in the acquisition and display of the image data as well as the task to be undertaken by the user with those images (e.g., detection, diagnosis, measurement, treatment recommendation, etc.) is critical to the outcome of the interpretation process.

WHY AN IMAGE PERCEPTION CONFERENCE?

The Image Perception Conference was established by Harold L. Kundel, MD (Department of Radiology, University of Pennsylvania) in 1994. He was the Chair of the conference from 1994 – 1998 and from 1999 – 2000 Elizabeth Krupinski, PhD (University of Arizona) was the Chair. Starting in 2001, the conference had grown enough to warrant two chairs and Dev Chakraborty, PhD (University of Pittsburgh) joined Dr. Krupinski until 2003. Since 2004 the Chairs have rotated on and off and have included: Miguel Eckstein, PhD (University of California Santa Barbara), Yulei Jiang, PhD (University of Chicago), Berkman Sahiner, PhD (FDA), David Manning, PhD (the first international Chair; Lancaster University), Craig Abbey, PhD (University of California Santa Barbara), and Claudia Mello-Thoms, PhD (University of Pittsburgh).
Since an independent Perception conference was not part of the Medical Imaging meeting in the early years, the question is why was one established? Dr. Kundel describes the rationale for establishing this conference track and some of his observations from attending over the years.

“Until 1964, papers about image perception submitted to the SPIE Medical Imaging Meeting were assigned mainly to the Physics and Image Processing Conferences. At the 1963 meeting Sam Dwyer suggested that the perception papers should be grouped together and he asked me to organize a Perception Conference for the 1964 meeting. I relied on submitted papers and a little recruitment to put together the first conference. The participants, whom I will not name for fear of either intimidating or omitting someone, included investigators from Canada, France, the Netherlands, Russia, the United Kingdom, and the United States. They represented universities, industry and government. The papers were grouped into five sections by topics that I believe are still relevant today.

1. Performance on Noise Limited Imaging Tasks;
2. Visual Search and Object Recognition;
3. Factors Determining Image Acceptance;
4. Measuring Observer Performance on Imaging Tasks;
5. Modeling the Human Observer.

Since its inception the simple title “Image Perception” has evolved into “Image Perception, Observer Performance, and Technology Assessment” perhaps to better reflect the subject matter. Imaging has also advanced from plain, projection images to computed tomography (CT), three dimensional imaging and, amazingly, stereoscopy, which was almost completely abandoned in the 1960s. Technological advances have not eliminated the need for humans to interpret images. Indeed, the problems of misinterpretation have not gone away. Computer aided diagnosis is still in its infancy and has a long way to go despite the arrival of the IBM Watson Supercomputer. Meanwhile it is both challenging and productive to try to understand the working of that exquisite pattern recognition apparatus - the human brain.”

Harold L. Kundel, M.D.
Professor Emeritus of Radiology
University of Pennsylvania
Philadelphia, PA
December 20, 2011

SOME FACTS & FIGURES

Everything discussed at the SPIE Medical Imaging meeting, whether overtly or implied, relates back to one fundamental idea – developing better tools/images for radiologists and other clinicians to render more effective and efficient diagnostic decisions to improve patient care. Thus image perception and observer performance issues are fundamental to the medical imaging field. The Image Perception track has covered a wide variety of areas over the years, including Methods for Assessing Performance, Mathematical Observer Modeling, Human-Computer Interface & Ergonomics, Eye-Tracking & Visual Search, and Clinical Decision Making.

The SPIE Medical Imaging Conference itself brings together a wide variety of people, but it is perhaps in the area of image perception that we have seen the greatest variety and change. The Image Perception track generally includes those investigating the process of extracting diagnostic information from medical images and rendering diagnostic decisions, and this therefore includes radiologists, psychologists, statisticians, physicists, engineers, and others in this growing research community. The investigators have come from universities, hospitals, private companies, and government agencies (e.g., NIH, FDA, military).
It is interesting and revealing to examine some of the facts and figures associated with the Image Perception Conference. The first conference in 1994 was chaired by Hal Kundel and the Program Committee included David Beard, Larry Cook, David Gur and Elizabeth Krupinski. There were 5 sessions at that meeting, and although the conference has expanded and the titles changed, these core sessions clearly served as the foundation for future meetings with the themes still present in today’s 2012 conference. The sessions as noted above were: “Performance on Noise-Limited Tasks”, “Observer Performance – Visual Search & Object Recognition”, “Factors Determining image Acceptance”, “Image System Evaluation – Performance Indices”, and “Modeling the Human Observer”. There were 24 talks across these 5 sessions. Participation in the poster session did not start until 1995.

For the 2012 conference there are two chairs and the Program Committee has 14 members, 6 of whom are international! There are now 8 sessions with 41 presentations plus 29 presentations in the poster session. As can be seen, the session topics, although broader, are still focused on the same key issues: “Technology Assessment”, “Image Display”, “ROC Analysis” “Image Perception”, “Digital Pathology I & II”, “Model Observers”, and “Observer Performance”. The notable addition in 2012 is the Digital Pathology sessions organized jointly with the Image Processing and Computer-Aided Diagnosis Conferences. The focus on Digital Pathology brings to the forefront the growth not only of the Perception Conference but the entire meeting as a whole, as it recognizes the importance of imaging in other clinical specialties and emphasizes the benefits derived from cross-fertilization of fields and sharing or ideas, tools, methods and results.

The first Keynote Address occurred at the 1998 meeting and was given by Art Burgess, PhD. The title of his talk was “From Light to Optic Nerve: Optimization of the Front End Visual Systems”. Since then the Keynotes have spanned a range of topics from pure perception to performance measurement to clinical applications and implications of image perception research. To pay tribute to the Conference founder and his significant contributions to medical image perception over the years, the Keynote lecture was named the “Harold Kundel Honorary Lecture” in 2007 and Hal gave the first keynote with the new title called “How to Minimize Perceptual Error and Maximize Expertise in Medical Imaging”. The Keynote Address for 2012 illustrates again the expanding scope of medical image perception, with Michael Becich, MD presenting “Pathology: Why the Future of Medicine’s Gold Standard is to go Digital”.

Workshops were not a part of the conference at the beginning, but have evolved into an integral part of the meeting for those interested in medical image perception. The focus of the workshops has varied over the years, but some of the more exciting ones have involved researchers bringing their “tools of the trade” to the meeting for others to view and interact with. For example, one year participants brought eye-position recording systems to the meeting, allowing many researchers to see first-hand for the first time the equipment used in many of the core visual search studies that had been presented at the SPIE Medical Imaging meeting in previous years. It is impossible to say definitively that this workshop and others that have highlighted eye-position recording tools caused researchers to get involved in eye-tracking, but there has been a steady growth in the use of these tools since these workshops were held with a significant amount of new and exciting research results produced.

The number of papers published in the SPIE Proceedings has naturally fluctuated over the years, but as Figure 1 shows there has been a steady increase in the Perception conference papers with 2012 reaching an all time high of 70! To some extent the number of papers presented in the Perception conference today is a function of the number of slots available and the time allotted to the conference during the meeting. Today the oral presentations span two full days of the meeting, with the workshop starting things off the night before Session I and the poster session taking place on the night of the first full day. In contrast, the first conference had no workshop, no keynote speakers and essentially took place in a single day. It has grown considerably over the years and we look forward to expanding even further in future years.
The SPIE Medical Imaging meeting and the Image Perception Conference in particular has fostering the growth of the medical image perception field in a number of key ways. The first “Far West Image Perception Conference” actually preceded the establishment of the SPIE Perception Conference as it was first held in 1985. Today it is called the “Medical Image Perception Meeting” and is hosted by the Medical Image Perception Society (MIPS). However, the two meetings over the years have complemented each other and brought together an array of researchers whose goal is to improve our understanding of the medical image interpretation process. The value of the SPIE Perception Conference is that it allows those researchers from other diverse fields (physics, ultrasound, robotics, CAD, image processing, PACS, etc.) to get a better idea of what medical image perception is all about by providing the ready opportunity to attend talks and view posters within the context of the greater Medical Imaging meeting. The 2012 meeting with the joint Digital Pathology sessions highlights the way that the various tracks, although independent, are also quite integrated and together foster new directions and improved understanding of medical imaging in general.

Another way that the SPIE meeting has fostered growth in medical image perception is through its efforts to foster and promote student participation. It is safe to say that nearly all of the subsequent Conference Chairs and Program Committee members since Dr. Kundel were at one time student presenters at the SPIE Medical Imaging Meeting in the Perception Conference! The value of the meeting in terms of providing opportunities for students to not only present their research, but also to interact with the experienced experts in the field is immeasurable. The Perception Conference provides a unique opportunity for students to attend a variety of sessions that cover everything from basic perception to vision modeling to technology evaluation and evaluation methods to clinical applications of perception research. The poster sessions in particular have provided burgeoning perception students with a valuable opportunity to present their research findings in an extended (and hopefully non-threatening?) environment where they can receive one-on-one feedback from experienced investigators. It also provides them

Investigation of the perceptual and cognitive factors underlying medical image interpretation is an important and valuable endeavor that contributes significantly to our continuing efforts to improve the detection, diagnosis and treatment of diseases to improve patient care and well-being. Collaborations between medical physicists, workstation
design engineers, image processing and image analysis scientists, and vision and cognitive psychologists should be encouraged to facilitate and promote further research in medical image perception so that patient care can be improved.

Radiology services, especially high-technology modalities, second opinion and teleradiology have increased significantly in recent years. Fewer radiologists now read more studies, each containing more images, in less time. The same is true in many of the other image-based clinical specialties, especially with the increase in telemedicine services being provided nationally and internationally. The visual tasks faced by radiologists and other imaging clinicians have continuously changed as new imaging techniques have arrived. As new technologies continue to evolve so will the demands placed on the diagnostic image interpretation process and thus on the interpreting clinicians. The effort required to process and manipulate images at the point of interpretation will continue to be at the forefront of medical imaging research. The need to understand how the clinician interacts with the images presented to them, how to enhance the development of expertise in interpretation, and how to optimize the images as well as the interpretation environment continues to grow. Image perception researchers will continue to lead the way in these efforts and will hopefully continue to have a home at the SPIE Medical Imaging Meeting to present their research findings, interact with the peers, and foster and find the mentorship and inspiration needed to take the field of medical image perception into the future.