

# Image Quality and System Performance XII

Mohamed-Chaker Larabi Sophie Triantaphillidou Editors

10–12 February 2015 San Francisco, California, United States

Sponsored by IS&T—The Society for Imaging Science and Technology SPIE

Published by SPIE

Volume 9396

Image Quality and System Performance XII, edited by Mohamed-Chaker Larabi, Sophie Triantaphillidou, Proc. of SPIE-IS&T Electronic Imaging, SPIE Vol. 9396, 939601 · © 2015 SPIE-IS&T CCC code: 0277-786X/15/\$18 · doi: 10.1117/12.2185155 The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publishers are not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in Image Quality and System Performance XII, edited by Mohamed-Chaker Larabi, Sophie Triantaphillidou, Proceedings of SPIE-IS&T Electronic Imaging, SPIE Vol. 9396, Article CID Number (2015)

ISSN: 0277-786X ISBN: 9781628414868

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

Copyright © 2015, Society of Photo-Optical Instrumentation Engineers and The Society for Imaging Science and Technology.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by the publishers 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 copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/15/\$18.00.

Printed in the United States of America.

**Paper Numbering:** Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print. Papers are published as they are submitted and meet publication criteria. A unique 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 as 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.

# Contents

vii	Authors
ix	Conference Committee
xi	Introduction
SESSION 1	IMAGE QUALITY AND IMAGING PROCESSING
9396 02	Advanced mechanisms for delivering high-quality digital content [9396-1]
9396 03	Towards assessment of the image quality in the high-content screening [9396-2]
9396 04	Information theoretic methods for image processing algorithm optimization [9396-4]
9396 05	Forward and backward tone mapping of high dynamic range images based on subband architecture [9396-5]
SESSION 2	DIGITAL PHOTOGRAPHY AND IMAGE QUALITY I, JOINT SESSION WITH CONFERENCES 9396 AND 9404
0207.00	ATT surfluction of white nivel sensors [020/ 0]
9396 08	MTF evaluation of white pixel sensors [9396-8]
9396 09	Intrinsic camera resolution measurement [9396-9]
SESSION 3	DIGITAL PHOTOGRAPHY AND IMAGE QUALITY II, JOINT SESSION WITH CONFERENCES 9396 AND 9404
9396 OA	Mobile phone camera benchmarking in low light environment [9396-10]
9396 OB	Luminance and gamma optimization for mobile display in low ambient conditions [9396-11]
SESSION 4	PRINT QUALITY I
9396 OD	A new method to evaluate the perceptual resolution [9396-13]
9396 OE	MFP scanner motion characterization using self-printed target [9396-14]
9396 OF	Autonomous detection of ISO fade point with color laser printers [9396-15]

## SESSION 5 PRINT QUALITY II

9396 OG	Autonomous detection of text fade point with color laser printers [9396-16]
9396 OH	Photoconductor surface modeling for defect compensation based on printed images [9396-17]
9396 OI	Controlling misses and false alarms in a machine learning framework for predicting uniformity of printed pages [9396-18]
9396 OJ	Estimation of repetitive interval of periodic bands in laser electrophotographic printer output [9396-19]
SESSION 6	
9396 OK	Image quality optimization, via application of contextual contrast sensitivity and discrimination functions [9396-20]
9396 OL	A study of slanted-edge MTF stability and repeatability [9396-21]
9396 OM	Comparative performance between human and automated face recognition systems, using CCTV imagery, different compression levels, and scene parameters [9396-22]
9396 ON	A study of image exposure for the stereoscopic visualization of sparkling materials [9396-23]
SESSION 7	SUBJECTIVE QUALITY ASSESSMENT
9396 00	QuickEval: a web application for psychometric scaling experiments [9396-24]
9396 OP	A database for spectral image quality [9396-25]
9396 OQ	Alternative performance metrics and target values for the CID2013 database [9396-26]
9396 OR	Extending subjective experiments for image quality assessment with baseline adjustments [9396-27]
9396 OS	Subjective quality of video sequences rendered on LCD with local backlight dimming at different lighting conditions [9396-28]
SESSION 8	SUBJECTIVE AND OBJECTIVE QUALITY ASSESSMENT
9396 OU	RGB-NIR color image fusion: metric and psychophysical experiments [9396-30]
9396 OV	Non-reference quality assessment of infrared images reconstructed by compressive sensing [9396-31]

9396 0W Study of the effects of video content on quality of experience [9396-32]

\_\_\_\_

- 9396 0X The effects of scene content parameters, compression, and frame rate on the performance of analytics systems [9396-33]
- 9396 OY How perception of ultra-high definition is modified by viewing distance and screen size [9396-34]

#### SESSION 9 OBJECTIVE QUALITY ASSESSMENT

- 9396 0Z A no-reference video quality assessment metric based on ROI [9396-35]
- 9396 10 Comparison of no-reference image quality assessment machine learning-based algorithms on compressed images [9396-36]
- 9396 11 Objective evaluation of slanted edge charts [9396-37]
- 9396 12 Evaluating the multi-scale iCID metric [9396-38]

### SESSION 10 DISPLAY QUALITY

- 9396 13 Image quality evaluation of LCDs based on novel RGBW sub-pixel structure [9396-39]
- 9396 14 Is there a preference for linearity when viewing natural images? [9396-41]

## Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Allebach, Jan P., OE, OF, OG, OI, OJ Andersen, Jakob Dahl, 0S Atanassov, Kalin, 08 Baek, Jong Sang, OB, 13 Battisti, Federica, OW Bauer, Peter, OE Bech, Søren, OS Benitez-Restrepo, H. D., OV Bertamío, Marcelo, 14 Bilissi, E., OM, OX Blahová, Jana, OP Bouzidi, Ines, 05 Burns, Peter D., 09 Carli, Marco, OW Charrier, Christophe, 10 Cooper, Brian E., OH Dokkeberg, Christopher André, 00 Doré, G., 0X Eid, Ahmed H., OH Farup, Ivar, 00 Fernandez-Maloigne, Christine, 10 Finlayson, Graham D., 0U Forchhammer, Søren, OS Fotheraill, Roberta, OF Fournier, Jérôme, OY Fry, Edward, OK Galil, Erez, 04 George, Sony, OP Gicquel, Jean-Charles, 0Y Goma, Sergio, 08 Gupta, Gaurav, OK Häkkinen, J., OQ Han, Taeseong, 13 Hardeberg, Jon Yngve, OP Hayes, Alex E., OU Hornung, Harvey (Hervé), 11 Jang, Junwoo, OB Janowski, Lucian, 02 Jarvis, John, OK Jessome, Renee J., OF, OG Jia, Lixiu, OZ Ju, Yanling, 0G Jung, Sooyeon, 13 Kane, David, 14 Kang, Dongwoo, 13 Kim, Jaekyeom, 13 Kim, Minwoong, OE Kim, Sungjin, 13 Kim, Taeuk, OB Korhonen, Jari, OS Lachat, Amélie, OY

Lafon-Pham, Dominique, ON Larabi, M.-C., OM, OX Lee, Jinsang, 13 Lee, Seonmee, OB Leisti, T., OQ Le Moan, Steven, OP, 12 Leszczuk, Mikołaj, 02 Lim, Moojong, OB, 13 Lindner, Albrecht, 08 Luo, Jiafu, 08 Maggard, Eric, OF, OG Mantel, Claire, 0S Martinez Bauza, Judit, 09 Medina, Victor, ON Montagna, Roberto, OU Nguyen, Minh Q., 0I Niu, Wenjuan, OZ Nuutinen, M., 0Q Ospina-Borras, J. E., OV Ouled Zaid, Azza, 05 Paljic, Alexis, ON Park, Jongjin, OB Park, Taeyong, OB Park, Yonamin, 13 Paudyal, Pradip, OW Pedersen, Jesper Melgaard, OS Pedersen, Marius, OO, OP, OR Peltoketo, Veli-Tapani, OA Preiss, Jens, 12 Prokushkin, Sergey F., 04 Psarrou, A., OM, OX Radun, J., OQ Roland, Jackson K. M., OL Saadane, AbdelHakim, 10 Sasahara, S., OD Seo, Woongjin, OB Storvik, Jehans Jr., 00 Triantaphillidou, Sophie, OK, OM, OX Tsifouti, A., OM, OX Tsoy, Yury, 03 Tu, Yan, OZ Uno, M., 0D Urban, Philipp, 12 Van Ngo, Khai, 00 Virtanen, T., OQ Wagner, Jerry K., 0E Yan, Ni, OF Yoo, Jang Jin, 13 Zhang, Jia, OJ Zhao, Ping, OR Zhong, Xuefei, OZ

## **Conference Committee**

Symposium Chair

Sheila S. Hemami, Northeastern University (United States)

Symposium Co-chair

Choon-Woo Kim, Inha University (Korea, Republic of)

Conference Chairs

Mohamed-Chaker Larabi, Université de Poitiers (France) Sophie Triantaphillidou, University of Westminster (United Kingdom)

#### Conference Program Committee

Nicolas Bonnier, Canon Information Systems Research Australia Pty. Ltd. (Australia) Peter D. Burns, Burns Digital Imaging (United States) Majed Chambah, Université de Reims Champagne-Ardenne (France) Luke C. Cui, Microsoft Corporation (United States) Mark D. Fairchild, Rochester Institute of Technology (United States) Susan P. Farnand, Rochester Institute of Technology (United States) Robert D. Fiete, ITT Exelis (United States) Frans Gaykema, Océ Technologies B.V. (Netherlands) Dirk W. Hertel, E Ink Corporation (United States) Robin B. Jenkin, Apple, Inc. (United States) Elaine W. Jin, Intel Corporation (United States) Sang Ho Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) Toshiya Nakaguchi, Chiba University (Japan) Göte S. Nyman, University of Helsinki (Finland) Stuart W. Perry, Canon Information Systems Research Australia Pty. Ltd. (Australia) D. René Rasmussen, Qi Analytics LLC (United States) Safaee-Rad Reza, Qualcomm Inc. (United States) Eric K. Zeise, Kodak's Graphic Communications Group (United States)

## Session Chairs

- Image Quality and Imaging Processing
  Mohamed-Chaker Larabi, Université de Poitiers (France)
- Digital Photography and Image Quality I, Joint Session with Conferences 9396 and 9404
   Sophie Triantaphillidou, University of Westminster (United Kingdom) Kevin J. Matherson, Microsoft Corporation (United States)
- Digital Photography and Image Quality II, Joint Session with Conferences 9396 and 9404
   Robin B. Jenkin, Apple, Inc. (United States)
   Kevin J. Matherson, Microsoft Corporation (United States)
- 4 Print Quality I
  Susan P. Farnand, Rochester Institute of Technology (United States)
- 5 Print Quality II Frans Gaykema, Océ Technologies B.V. (Netherlands)
- 6 Imaging Performance Peter D. Burns, Burns Digital Imaging (United States)
- 7 Subjective Quality Assessment Göte S. Nyman, University of Helsinki (Finland)
- 8 Subjective and Objective Quality Assessment Sang Ho Kim, Samsung Digital City (Korea, Republic of)
- 9 Objective Quality Assessment
  Stuart W. Perry, Canon Information Systems Research Australia Pty. Ltd. (Australia)
- 10 Display Quality Elaine W. Jin, Intel Corporation (United States)

# Introduction

Over the last decade, the Image Quality and System Performance (IQSP) conference has covered a wide range of topics relating to the evaluation of imaging system performance, the definition of the perceived image quality, and often the interrelationship between them. The perceived quality of images is of crucial importance in visual arts, as well as in commercial, scientific and entertaining application environments. Developments in display technologies, digital printing, imaging sensors, image processing, and 3D imaging are enabling new (or enhanced) possibilities for creating and conveying visual content that informs or entertains. Wireless networks and mobile devices expand the ways to share imagery.

Following the tradition of the 10 previous IQSP volumes, this volume includes research brought by industrial and academic engineers and scientists who strive to understand how humans judge images, how to quantify image quality, what makes high-quality imagery, and how to assess the requirements and performance of modern imaging systems. It comprises peer-reviewed contributions that cover research and applications throughout the imaging chain on: the methodologies and standards for quantifying perceptual quality and imaging performance; the evaluation of captured, compressed, displayed and print quality; objective and subjective video quality evaluation; and 3D image quality.

We hope Image Quality and System Performance XII is a useful reference to all those interested in present-day research on image quality and imaging-system performance.

Chaker Larabi Sophie Triantaphillidou