PROCEEDINGS
IS&T SPIE. ELECTRONIC IMAGING

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

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

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.

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

1 Image Quality and Imaging Processing
Mohamed-Chaker Larabi, Université de Poitiers (France)

2 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)

3 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