

# **Digital Photography XI**

Nitin Sampat Radka Tezaur Dietmar Wüller Editors

9–10 February 2015 San Francisco, California, United States

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

Cosponsored by Nikon (United States) Canon (United States) Google (United States)

Published by SPIE

Volume 9404

Digital Photography XI, edited by Nitin Sampat, Radka Tezaur, Dietmar Wüller, Proc. of SPIE-IS&T Electronic Imaging SPIE Vol. 9404, 940401 · © 2015 SPIE-IS&T · CCC code: 0277-786X/15/\$18 · doi: 10.1117/12.2190584

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 Digital Photography XI, edited by Nitin Sampat, Radka Tezaur, Dietmar Wüller, Proceedings of SPIE-IS&T Electronic Imaging, SPIE Vol. 9404, Article CID Number (2015)

ISSN: 0277-786X ISBN: 9781628414943

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

V	Authors
V	AUINOIS

vii Conference Committee

SESSION 1	COMPUTATIONAL PHOTOGRAPHY AND IMAGE PROCESSING I
9404 02	Multimode plenoptic imaging [9404-1]
9404 03	Automatically designing an image processing pipeline for a five-band camera prototype using the local, linear, learned (L <sup>3</sup> ) method [9404-2]
9404 04	Efficient illuminant correction in the local, linear, learned (L <sup>3</sup> ) method [9404-3]
SESSION 2	IMAGE RESTORATION
9404 05	Reflection removal in smart devices using a prior assisted independent components analysis [9404-4]
9404 06	Measurement and analysis of the point spread function with regard to straylight correction [9404-5]
SESSION 3	DEBLURRING I
9404 09	Parameterized modeling and estimation of spatially varying optical blur (Invited Paper) [9404-8]
SESSION 4	DEBLURRING II
9404 OB	Blind deconvolution of images with model discrepancies using maximum a posteriori estimation with heavy-tailed priors (Best Student Paper Award) [9404-10]
9404 OC	Motion deblurring with graph Laplacian regularization [9404-11]
9404 OD	A system for estimating optics blur PSFs from test chart images [9404-12]
SESSION 5	COMPUTATIONAL PHOTOGRAPHY AND IMAGE PROCESSING II
9404 OF	Gradient-based correction of chromatic aberration in the joint acquisition of color and near-infrared images [9404-14]
9404 0G	Visible and near-infrared image fusion based on visually salient area selection [9404-15]

9404 OH	Fast HDR image upscaling using locally adapted linear filters [9404-16]
9404 OI	Cinematic camera emulation using two-dimensional color transforms [9404-17]
SESSION 6	DIGITAL PHOTOGRAPHY AND IMAGE QUALITY I, JOINT SESSION WITH CONFERENCES 9396 AND 9404
9404 OJ	Image quality assessment using the dead leaves target: experience with the latest approach and further investigations [9404-18]
SESSION 7	DIGITAL PHOTOGRAPHY AND IMAGE QUALITY II, JOINT SESSION WITH CONFERENCES 9396 AND 9404
9404 OK	An ISO standard for measuring low light performance [9404-19]
9404 OL	ISO-less? [9404-20]
	INTERACTIVE PAPER SESSION
9404 OM	Overcoming the blooming effect on autofocus by fringe detection [9404-21]
9404 ON	Stable image acquisition for mobile image processing applications (Best Paper Award) [9404-22]
9404 00	Near constant-time optimal piecewise LDR to HDR inverse tone mapping [9404-23]
9404 OP	Face super-resolution using coherency sensitive hashing [9404-24]
9404 OQ	An evaluation of the effect of JPEG, JPEG2000, and H.264/AVC on CQR codes decoding process [9404-25]
9404 OR	Stitching algorithm of the images acquired from different points of fixation [9404-26]

### 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.

Achatzi, Julian, 06 Akinola, Iretiayo A., 04 Artmann, Uwe, OJ Blasinski, Henryk, 03 Bonnet, Gerhard, 06 Chen, Homer H., 0M Chen, Qian, 00 Choudhury, Anustup, OP Dietz, Henry Gordon, OL Eberhart, Paul Selegue, OL Farias, Mylène C. Q., 0Q Farrell, Joyce E., 03 Fischer, Gregor, 06 Fritze, Alexander, ON Fukunishi, Munenori, 03 Georgiev, Todor, 02 Germain, Francois G., 04 Gillich, Eugen, ON Gish, Walter, Ol Henning, Kai-Fabian, ON Hong, Li, OD Huang, Shao-Kang, OM Jiang, Haomiao, 03 Kalwad, Pramati, 05 Kamata, Tetsuji, OD Kheradmand, Amin, 0C Kotera, Jan, OB Lansel, Steven, 03, 04 Lohweg, Volker, ON Lu, Yue M., OF Lumsdaine, Andrew, 02 Marchuk, V. I., OR McElvain, Jon S., Ol Milanfar, Peyman, OC Mönks, Uwe, ON Okutomi, Masatoshi, 0G Paulus, Dietrich, 06 Peddigari, Venkat, 05 Pismenskova, M. M., OR Prakash, Divya, 05 Sadeghipoor, Zahra, OF Segall, Andrew, OP Semenishchev, E. A., OR Shibata, Takashi, OG Simpkins, Jonathan D., 09 Slonaker, Stephen S., OD Srinivasa, Phanish, 05 Šroubek, Filip, OB Stevenson, Robert L., 09

Su, Guan-Ming, 0H, 0O Süsstrunk, Sabine, 0F Talebi, Hossein, 0H Tanaka, Masayuki, 0G Tezaur, Radka, 0D Tian, Qiyuan, 03, 04 Tsai, Dong-Chen, 0M Vizcarra Melgar, Max E., 0Q Voronin, V. V., 0R Wandell, Brian A., 03, 04 Wueller, Dietmar, 0K Yin, Peng, 0H, 0O Zaghetto, Alexandre, 0Q Zimmer, Volker, 06

## **Conference Committee**

Symposium Chair

Sheila S. Hemami, Northeastern University (United States)

#### Symposium Co-chair

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

#### **Conference** Chairs

Nitin Sampat, Rochester Institute of Technology (United States) Radka Tezaur, Nikon Research Corporation of America (United States) Dietmar Wüller, Image Engineering GmbH & Company KG (Germany)

#### Conference Co-chairs

Sebastiano Battiato, Università degli Studi di Catania (Italy) Joyce E. Farrell, Stanford University (United States) Boyd A. Fowler, Google (United States) Francisco H. Imai, Canon U.S.A., Inc. (United States) Andrew Lumsdaine, Indiana University (United States) Kevin J. Matherson, Microsoft Corporation (United States)

#### Conference Program Committee

Erhardt Barth, Universität zu Lübeck (Germany) Kathrin Berkner, Ricoh Innovations, Inc. (United States) Ajit S. Bopardikar, Samsung Electronics, India Software Operations Ltd. (India) Frédéric Cao, DxO Laboratories (France) Peter B. Catrysse, Stanford University (United States) Lauren A. Christopher, Indiana University-Purdue University Indianapolis (United States) Henry G. Dietz, University of Kentucky (United States) Paolo Favaro, Universität der Künste Berlin (Germany) Robert D. Fiete, Exelis Geospatial Systems (United States) Sergio R. Goma, Qualcomm Inc. (United States) Mirko Guarnera, STMicroelectronics (Italy) Bahadir K. Gunturk, Louisiana State University (United States) Zhen He, Intel Corporation (United States) Paul M. Hubel, Apple Inc. (United States)

Jun Jiang, Apple Inc. (United States) Michael A. Kriss, MAK Consultants (United States) Jiangtao Kuang, OmniVision Technologies, Inc. (United States) Manuel Martinez, Universitdad de València (Spain) Jon S. McElvain, Dolby Laboratories, Inc. (United States) Lingfei Meng, Ricoh Innovations, Inc. (United States) David P. Morgan-Mar, Canon Information Systems Research Australia Pty. Ltd. (Australia) Bo Mu, BAE Systems (United States) Barbara Pitts, Apple Inc. (United States) Kari A. Pulli, NVIDIA Corporation (United States) John R. Reinert-Nash, Lifetouch, Inc. (United States) Brian G. Rodricks, Consultant (United States) Jackson Roland, Imatest, LLC (United States) Mårten Sjöström, Mid Sweden Universitet (Sweden) Filippo D. Stanco, Università degli Studi di Catania (Italy) Sabine Süsstrunk, Ecole Polytechnique Fédérale de Lausanne (Switzerland) Touraj Tajbakhsh, Apple Inc. (United States) Ashok Veeraraghavan, Rice University (United States) **Thomas Vogelsang**, Rambus Inc. (United States) Michael Wang, Intel Corporation (United States) Weihua Xiong, OmniVision Technologies, Inc. (United States) **Zhan Yu**, University of Delaware (United States) Lei Zhang, The Hong Kong Polytechnic University (Hong Kong, China)

#### Session Chairs

- 1 Computational Photography and Image Processing I Sebastiano Battiato, Università degli Studi di Catania (Italy)
- 2 Image Restoration **Nitin Sampat**, Rochester Institute of Technology (United States)
- 3 Deblurring I **Radka Tezaur**, Nikon Research Corporation of America (United States)
- 4 Deblurring II **Filip Sroubek**, Institute of Information Theory and Automation (Czech Republic)

- 5 Computational Photography and Image Processing II Joyce E. Farrell, Stanford University (United States)
- 6 Digital Photography and Image Quality I, Joint Session with Conference 9396 and 9404
  Sophie Triantaphillidou, University of Westminster (United Kingdom) Kevin J. Matherson, Microsoft Corporation (United States)
- 7 Digital Photography and Image Quality II, Joint Session with Conference 9396 and 9404
  Robin B. Jenkin, Apple, Inc. (United States)
  Kevin J. Matherson, Microsoft Corporation (United States)