

# PROCEEDINGS OF SPIE

## ***Computational Imaging***

**Abhijit Mahalanobis**  
**Kenneth S. Kubala**  
**Amit Ashok**  
**Jonathan C. Petruccelli**  
**Lei Tian**  
*Editors*

**17–18 April 2016**  
**Baltimore, Maryland, United States**

*Sponsored and Published by*  
SPIE

**Volume 9870**

Proceedings of SPIE 0277-786X, V. 9870

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

Computational Imaging, edited by Abhijit Mahalanobis, Kenneth S. Kubala, Amit Ashok,  
Jonathan C. Petruccelli, Lei Tian, Proc. of SPIE Vol. 9870, 987001 · © 2016 SPIE  
CCC code: 0277-786X/16/\$18 · doi: 10.1117/12.2244117

Proc. of SPIE Vol. 9870 987001-1

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at [SPIDigitalLibrary.org](http://SPIDigitalLibrary.org).

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Computational Imaging*, edited by Abhijit Mahalanobis, Kenneth S. Kubala, Amit Ashok, Jonathan C. Petrucci, Lei Tian, Proceedings of SPIE Vol. 9870 (SPIE, Bellingham, WA, 2016) Six-digit Article CID Number.

ISSN: 0277-786X  
ISSN: 1996-756X (electronic)  
ISBN: 9781510601116

Published 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](http://SPIE.org)

Copyright © 2016, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at [copyright.com](http://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/16/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL  
LIBRARY**  
[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- 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.

# Contents

v *Authors*  
vii *Conference Committee*

<b>SESSION 1</b>	<b>COMPUTATIONAL SPECTRAL IMAGING</b>
9870 03	<b>Computational hyperspectral unmixing using the AFSSI-C [9870-2]</b>
9870 04	<b>Compressive spectral imaging using multiple snapshot colored-mosaic detector measurements [9870-3]</b>
<b>SESSION 2</b>	<b>COMPRESSIVE IMAGING</b>
9870 06	<b>Hurdles in the implementation of compressive sensing for imaging and ways to overcome them (Invited Paper) [9870-5]</b>
9870 07	<b>Independent component analysis for improving the quality of interferometric products [9870-6]</b>
9870 08	<b>Scalable information-optimal compressive target recognition [9870-7]</b>
9870 09	<b>Parallel computing for simultaneous iterative tomographic imaging by graphics processing units [9870-8]</b>
<b>SESSION 3</b>	<b>PHASE IMAGING</b>
9870 0A	<b>An optimized transport-of-intensity solution for phase imaging (Invited Paper) [9870-9]</b>
9870 0B	<b>Digital holographic phase imaging of particles embedded in microscopic structures in three dimensions [9870-10]</b>
9870 0C	<b>Transport of intensity phase imaging using Bessel sources [9870-11]</b>
<b>SESSION 4</b>	<b>COMPUTATIONAL OPTICAL DESIGN</b>
9870 0F	<b>High resolution image reconstruction from projection of low resolution images differing in subpixel shifts [9870-14]</b>
9870 0G	<b>Evaluation of the durability of 3D printed keys produced by computational processing of image data [9870-15]</b>

**SESSION 5 COMPUTATIONAL ILLUMINATION**

---

9870 0J **Segmentation and outline detection in underwater video images using particle filters**  
[9870-18]

**SESSION 6 COMPUTATIONAL IMAGING AT EXTREME LIMIT**

---

9870 0M **The algorithm stitching for medical imaging** [9870-21]

## 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.

Arce, Gonzalo R., 04  
Arguello, Henry, 04  
Ashok, Amit, 08  
August, Isaac Y., 06  
Banerjee, Partha, 0A  
Basunia, Mahmudunnabi, 0A  
Bello-Maldonado, Pedro D., 09  
Bennett, Jerome, 0F  
Chakraborty, Tonmoy, 0C  
Charalampidis, Dimitrios, 0J  
Correa, Claudia V., 04  
Desta, Habben, 0B  
Gehm, Michael E., 03  
Hinojosa, Carlos A., 04  
Ioup, George E., 0J  
Ioup, Juliette W., 0J  
Jin, Yuanwei, 09  
Karathanassi, V., 07  
Kerlin, Scott, 0G  
Kerviche, Ronan, 08  
Khmaladze, Alexander, 0B  
Le Moigne, Jacqueline, 0F  
López, Ricardo, 09  
Lu, Enyue, 09  
Maloney, Maxwell C., 0B  
Marchuk, V., 0M  
Mareboyana, Manohar, 0F  
Oiknine, Yaniv, 06  
Park, Jun Yong, 0B  
Petruccelli, Jonathan C., 0C  
Pismenskova, M., 0M  
Poon, Phillip K., 03  
Poon, Ting-Chung, 0A  
Rogers, Colleen, 09  
Saçellari Likoka, A., 07  
Semenishchev, E., 0M  
Sharikova, Anna, 0B  
Stern, Adrian, 06  
Straub, Jeremy, 0G  
Svirin, I., 0M  
Tolstova, I., 0M  
Vafeiadi-Bila, E., 07  
Vera, Esteban, 03  
Voronin, V., 0M  
Yoerger, Edward J., 0J  
Zhang, Hongbo, 0A



# Conference Committee

## *Symposium Chair*

**Ming C. Wu**, University of California, Berkeley (United States)

## *Symposium Co-chair*

**Majid Rabbani**, Eastman Kodak Company (United States)

## *Conference Chairs*

**Abhijit Mahalanobis**, Lockheed Martin Missiles and Fire Control  
(United States)

**Kenneth S. Kubala**, FiveFocal LLC (United States)

**Amit Ashok**, College of Optical Sciences, The University of Arizona  
(United States)

**Jonathan C. Petruccelli**, University at Albany (United States)

**Lei Tian**, University of California, Berkeley (United States)

## *Conference Program Committee*

**Mark A. Anastasio**, Washington University in St. Louis (United States)

**Thomas G. Bifano**, Boston University (United States)

**Oliver Cossairt**, Northwestern University (United States)

**Joseph E. Ford**, University of California, San Diego (United States)

**Michael E. Gehm**, Duke University (United States)

**Rajesh Menon**, The University of Utah (United States)

**Adrian Stern**, Ben-Gurion University of the Negev (Israel)

**Andreas Velten**, University of Wisconsin-Madison (United States)

**Laura Waller**, University of California, Berkeley (United States)

**Ge Wang**, Rensselaer Polytechnic Institute (United States)

**Gordon Wetzstein**, Stanford University (United States)

**Zeev Zalevsky**, Bar-Ilan University (Israel)

## *Session Chairs*

- 1 Computational Spectral Imaging  
**Robert R. Muise**, Lockheed Martin Missiles and Fire Control  
(United States)

- 2 Compressive Imaging  
**Amit Ashok**, College of Optical Sciences, The University of Arizona  
(United States)
- 3 Phase Imaging  
**Lei Tian**, University of California, Berkeley (United States)
- 4 Computational Optical Design  
**Jonathan C. Petruccelli**, University at Albany (United States)
- 5 Computational Illumination  
**Jonathan C. Petruccelli**, University at Albany (United States)
- 6 Computational Imaging at Extreme Limit  
**Amit Ashok**, College of Optical Sciences, The University of Arizona  
(United States)