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IS&T International Symposium on

Electronic Imaging

SCIENCE AND TECHNOLOGY

14–18 February 2016 • San Francisco, CA, USA

PROCEEDINGS

Image Sensors and Imaging Systems 2016

Editors: **Arnaud Darmont,** APHESA SPRL (Belguim); **Antoine Dupret,** Commissariat à l'Énergie Atomique (France); and **Ralf Widenhorn,** Portland State Univ. (USA)

These papers represent the program of Electronic Imaging 2016,
held February 14-18, 2016, at the Hilton San Francisco, Union Square in San Francisco, CA.

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Image Sensors and Imaging Systems 2016

Image Sensors and Imaging Systems 2016

Introduction

Solid state optical sensors and solid state cameras have established themselves as the imaging systems of choice for many demanding professional applications such as scientific and industrial applications. The advantages of low-power, low-noise, high-resolution, high-geometric fidelity, broad spectral sensitivity, and extremely high quantum efficiency have led to a number of revolutionary uses. This conference aims at being a place of exchanges and at giving the opportunity to a quick publication of new works in the areas of solid state detectors, solid state cameras, new optical concepts and novel applications.

Conference topics include:

Advances in technologies and models
- innovative devices
- innovative process and post-process (e.g., 3D integration)
- advances in alternative technologies (organic, a-Si, etc.)
- noise analysis and noise reduction
- advanced/novel image sensor or pixel control circuits
- advanced/novel defects and noise reduction algorithms
- color pattern or pixel architectures and color demosaicing and reconstruction techniques
- ADCs

High-end image sensors
- high speed
- large format
- ultra low power
- ultra low noise
- very high dynamic range

On-chip processing for smarter sensors
- on chip signal or image processing
- image sensors for 3D imaging
- bio-inspired image sensor
- interface standards for industrial cameras (e.g. CameraLink, CameraLinkHS, IIDC/DCAM, GigEVision GenICam, CoaXpress, USB3, direct PCIe cameras)

Image sensors assessment and novel implementations or applications
- hyperspectral sensors or camera
- image sensors for computational imaging

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Image Sensors and Imaging Systems 2016

Wednesday, February 17, 2016

Image Sensors and Algorithms for High Dynamic Range

Session Chair: Arnaud Darmont, APHESA SPRL (Belgium)

8:40 – 10:20 am
Golden Gate 4

8:40
Conference Remarks

8:50 IMSE-260
A high dynamic range linear vision sensor with event asynchronous and frame-based synchronous operation, *Juan A. Leñero-Bardallo, Ricardo Carmona-Galán, and Angel Rodríguez-Vázquez, Universidad de Sevilla (Spain)*

9:10 IMSE-261
A dual-core highly programmable 120dB image sensor, *B. Dupont, J. Caranana, P.A. Pinoncely, J. Michelot, C. Bouvier, S. Cohet, P. Jourdain, P. Monsinjon, Pyxalis (France)*

9:30 IMSE-262
Analog current mode implementation of global and local tone mapping algorithm for wide dynamic range image display, *Peng Chen, Kartikeya Murari, and Orly Yadid-Pecht, Univ. of Calgary (Canada)*

9:50 IMSE-263
Novel real-time tone mapping operator for noisy logarithmic CMOS image sensors (JIST-first), *Jing Li, Orit Skorka, Kamal Ranaweera, and Dileepan Joseph, University of Alberta (Canada)*

10:10
High dynamic range challenges

Short presentation by Arnaud Darmont

10:20 – 10:50 am Coffee Break

Novel Image Sensors and Image Sensor Technologies

Session Chair: Antoine Dupret, CEA (France)

10:50 am – 12:40 pm
Golden Gate 4

10:50 IMSE-264
Image sensor with organic photoconductive films by stacking the red/green and blue components, *T. Takagi, H. Seo, T. Sakai, and H. Ohtake, Japan Broadcasting Corporation; and M. FurutaKochi University of Technology (Japan)*

11:10 IMSE-265
High-sensitivity CMOS image sensor overlaid with Ga_2O_3/CIGS heterojunction photodiode, *Kazunori Miyakawa[1], Shigeyuki Imura[1], Hiroshi Ohtake[1], Misao Kubota[1], Kenji Kikuchi[2], Tokio Nakada[3], Toru Okino[4], Yutaka Hirose[4], Yoshihisa Kato[4], and Nobukazu Teranishi[5,6]; [1]NHK Science and Technology Research Laboratories, [2]NHK Sapporo Station, [3]Tokyo University of Science, [4]Panasonic Corporation, [5]University of Hyogo, and [6]Shizuoka University (Japan)*

11:30 IMSE-266
Sub-micron pixel CMOS image sensor with new color filter patterns, *Biay-Cheng Hseih[1], Sergio Goma[1], Hasib Siddiqui[1], Kalin Atanassov[1], Jiafu Luo[1], RJ Lin[2], Hy Cheng[2], Kuoyu Chou[2], JJ Sze[2], and Calvin Chao[2]; [1]Qualcomm Technologies Inc. (USA) and [2]TSMC (Taiwan)*

11:50 IMSE-267
A CMOS image sensor with variable frame rate for low-power operation, *Byoung-Soo Choi, Sung-Hyun Jo, Myunghan Bae, Sang-Hwan Kim, and Jang-Kyoo Shin, Kyungpook National University (South Korea)*

12:10 IMSE-268
ADC techniques for optimized conversion time in CMOS image sensors, *Cedric Pastorelli[1,2,3], Pascal Mellot[1], S. Mir[2,3], and C. Tubert[1]; [1]STMicroelectronics, [2]Université Grenoble Alpes, and [3]CNRS, TIMA (France)*

12:30
Best paper/best student paper

Presentation and awards for the best paper/best student paper and sponsor presentation

12:40 – 2:00 pm Lunch Break

EI 2016 Wednesday Plenary and Symposium Awards
Session Chair: Choon-Woo Kim (Inha University)
2:00 – 3:00 PM
Continental Ballroom 5

Intel® RealSense Technology: Adding human-like sensing and interactions to computing devices, *Achin Bhowmik, Intel Corporation (USA)*

3:00 – 3:30 pm Coffee Break

Cameras and Systems

Session Chair: Boyd Fowler, OmniVision Technologies (USA)

3:30 – 5:30 pm
Golden Gate 4

3:30 IMSE-269
Miniature lensless computational infrared imager, *Evan Erickson, Mark Kellam, Patrick Gill, James Tringali, and David Stork, Rambus Labs (USA)*

3:50 IMSE-270
Focal-plane scale space generation with a 6T pixel architecture, *Fernanda D.V.R. Oliveira[1], José Gabriel R.C. Gomes[1], Ricardo Carmona-Galán[2], Jorge Fernández-Berni[2], and Angel Rodríguez-Vázquez[2]; [1]Universidade Federal do Rio de Janeiro (Brazil) and [2]Instituto de Microelectrónica de Sevilla (Spain)*

4:10 IMSE-271
Development of an 8K full-resolution single-chip image acquisition system, *Tomohiro Nakamura, Ryohei Funatsu, Takahiro Yamasaki, Kazuya Kitamura, and Hiroshi Shimamoto, Japan Broadcasting Corporation (NHK) (Japan)*

4:30 IMSE-272
Smart digital camera based on spatial pre-processing filtering and spike generation, *Michel Paindavoine, Univ Bourgogne Franche-Comte (France)*

4:50 IMSE-273
Estimation and correction of geometric distortion in pushbroom hyperspectral system for imaging art paintings, *Sony George and Jon Yngve Hardeberg, Gjøvik University College (Norway)*

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5:10
Preview of posters and Thursday sessions

EI 2016 Symposium Interactive Papers Session
5:30 – 7:00 PM
Continental Ballroom 6

Image Sensors and Imaging Systems 2016 Interactive Papers Session

5:30 – 7:00 pm
Continental Ballroom 6

The following works will be presented at the EI 2016 Symposium Interactive Papers Session.

IMSE-274
EMVA1288 3.1rc2 and research on version 3.2 and next, *Arnaud Darmont and Adrien Lombet, APHESA SPRL (Belgium)*

IMSE-275
Software environment for holistic Vision-System-on-Chip programming, *Peter Reichel, Jens Döge, Nico Peter, Christoph Hoppe, Andreas Reichel, and Peter Schneider, Fraunhofer Institute for Integrated Circuits (IIS) (Germany)*

Thursday, February 18, 2016

Algorithms for Image Sensors and Camera Systems

Session Chair: Alice Reinheimer, e2v (USA)

8:50 – 10:10 am
Golden Gate 4

8:50 IMSE-276
FPGA implementation of gamma correction using a piecewise linear approach for a small size endoscopic camera, *Sheikh Shanawaz Mostafa[1], L. Natércia Sousa[1], Nuno Fábio Ferreira[1,2], Ricardo M. Sousa[3], Joao Santos[3], F. Morgado-Dias[1,2], Martin Wäny[3]; [1]Madeira Interactive Technologies Institute, Madeira Tecnopolo, [2]University of Madeira, [3]Awaiba Lda, Madeira Tecnopolo (Portugal)*

9:10 IMSE-277
Non-negative Matrix Completion for the enhancement of Snapshot Mosaic Multispectral Imagery, *Grigorios Tsagkatakis[1], Murali Jayapala[2], Bert Geelen[2], and Panagiotis Tsakalides[1,3]; [1]FORTH (Greece) and [2]IMEC (Belgium), [3]University of Crete (Greece)*

9:30 IMSE-278
Trade-off between the number of bits per pixel and motion detection quality for a low power image sensor, *Camille Dupoiron, Arnaud Verdant, and Gilles Sicard, CEA LETI (France)*

9:50 IMSE-279
Development of an 8K UHDTV demosaicing processor using adaptive interpolation based on local edge magnitude, *Noriyuki Shirai and Yukihiro Nishida, NHK Science and Technology Research Laboratories (Japan)*

10:10 – 10:50 am Coffee Break

Noise, Defects and Characterization

Session Chair: Ralf Widenhorn, Portland State University (USA)

10:50 am – 12:10 pm
Golden Gate 4

10:50 IMSE-280
Characterization of VNIR hyperspectral sensors with monolithically integrated optical filters, *Prashant Agrawal[1], Klaas Tack[1], Bert Geelen[1], Bart Masschelein[1], Pablo Mateo Aranda Moran[2], Andy Lambrechts[1], and Murali Jayapala[1]; [1]Imec and [2]TMC (Belgium)*

11:10 IMSE-281
A 1.12-um pixel CMOS image sensor survey, *Clemenz Portmann, Lele Wang, Guofeng Liu, Ousmane Diop, and Boyd Fowler, Google Inc. (USA)*

11:30 IMSE-282
A comparative noise analysis and measurement for n-type and p-type pixels with CMS technique, *Xiaoliang Ge[1], Bastien Mamdy[2,3], and Albert Theuwissen[1,4]; [1]Technische Universiteit Delft (Netherlands), [2]STMicroelectronics (France), [3]Universite Claude Bernard Lyon 1 (France), and [4]Harvest Imaging (Belgium)*

11:50 IMSE-283
Increases in hot pixel development rates for small digital pixel sizes, *Glenn H. Chapman, Rahul Thomas, Rohan Thomas, Klinsmann J. Coelho, Silva Meneses, and Tommy Q. Yang, Simon Fraser University (Canada); Israel Koren and Zahava Koren, University of Massachusetts Amherst (USA)*

12:10 – 1:50 pm Lunch Break

3DIPM/IMSE: Image Sensors and Systems for 3D Imaging Joint Session

Session Chair: William Puech, University of Montpellier (France)

1:50 – 3:20 pm
Golden Gate 6/7

This session is jointly sponsored by: Image Sensors and Imaging Systems 2016, and 3D Image Processing, Measurement (3DIPM), and Applications 2016.

1:50
Joint conference introduction

2:00 IMSE-048
A time-of-flight CMOS range image sensor using 4-tap output pixels with lateral-electric-field control, *Taichi Kasugai[1], Sang-Man Han[1], Hanh Trang[1], Taishi Takasawa[1], Satoshi Aoyama[2], Keita Yasutomi[1], Keiichiro Kagawa[1], and Shoji Kawahito[1]; [1]Shizuoka University and [2]Brookman Technology (Japan)*

2:20 IMSE-049
Design, implementation and evaluation of a TOF range image sensor using multi-tap lock-in pixels with cascaded charge draining and modulating gates, *Hanh Trang and Taichi Kasugai, Shizuoka Univ. (Japan); Keigo Isobe, Brookman Technology (Japan); Sang Man Han, Taichi Takasawa, De Xing Lioe, Keita Yasutomi, Keiichiro Kagawa, and Shoji Kawahito, Shizuoka Univ. (Japan)*

2:40 3DIPM-050
Markerless motion capture with multi-view structured light, *Ricardo Garcia and Avideh Zakhor, University of California, Berkeley (USA)*

3:00 3DIPM-051
Towards automated, high resolution 3D scanning of large surfaces for cultural heritage documentation, *Robert Sitnik[1], Eryk Bunsch[2], Grzegorz Maczkowski[1], Wojciech Zaluski[1], Krzysztof Lech[1], Jakub Michonski[1], and Jakub Krzeslowski[1]; [1]Warsaw University of Technology and [2]Museum of King Jan III's Palace at Wilanów (Poland)*