

## Image Sensors and Imaging Systems 2016

### Conference grouping: Image Capture Systems

Conferences in this grouping discuss advances in traditional and non-traditional digital cameras and their image processing pipelines; plenoptic devices; sensors for low-light imaging; very high dynamic range sensors and cameras; hyperspectral sensors and cameras; wearable multimedia systems; mobile games; multimedia data mining; and HCI design and techniques, among other topics.

### Conference overview

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. To encourage the discussion a set of high level invited talks is followed by a panel discussion. To encourage young talent, a best student paper contest is organized.

**Awards:** Best Paper Award, Best Student Paper Award

**Joint Sessions:** Image Sensors and Systems for 3D Imaging with the 3D Image Processing, Measurement and Applications Conference.



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

**Program Committee:** Morley M. Blouke, Portland State Univ. (retired) (USA); Erik Bodegom, Portland State Univ. (USA); Calvin Chao, TSMC (Taiwan); Glenn H. Chapman, Simon Fraser Univ. (Canada); James A. DiBella, ON Semiconductor (USA); Boyd A. Fowler, Google (USA); Bumsuk Kim, Samsung Electronics Co., Ltd (Republic of Korea); Rihito Kuroda, Tohoku Univ. (Japan); Kevin J. Matherson, Microsoft Corp. (USA); Alice L. Reinheimer, e2v (USA); Gilles Sicard, Commissariat à l'Énergie Atomique (France); Nobukazu Teranishi, Univ. of Hyogo (Japan); Jean-Michel Tualle, Univ. Paris 13 (France); Gordon Wan, Google Inc. (USA); and Xinyang Wang, GPIXEL (China)

### Conference Sponsors



## 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**, Benoit Dupont, 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**, Tomomi Takagi<sup>1</sup>, Toshikatu Sakai<sup>1</sup>, Kazunori Miyakawa<sup>1</sup>, and Mamoru Furuta<sup>2</sup>; <sup>1</sup>NHK Science & Technology Research Laboratories and <sup>2</sup>Kochi University of Technology (Japan)

11:10

IMSE-265

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

11:30

IMSE-266

**Sub-micron pixel CMOS image sensor with new color filter patterns**, Biay-Cheng Hseih<sup>1</sup>, Sergio Goma<sup>1</sup>, Hasib Siddiqui<sup>1</sup>, Kalin Atanassov<sup>1</sup>, Jiafu Luo<sup>1</sup>, RJ Lin<sup>2</sup>, Hy Cheng<sup>2</sup>, Kuoyu Chou<sup>2</sup>, JJ Sze<sup>2</sup>, and Calvin Chao<sup>2</sup>; <sup>1</sup>Qualcomm Technologies Inc. (USA) and <sup>2</sup>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<sup>1</sup> and Pascal Mello<sup>2</sup>; <sup>1</sup>ANRT and <sup>2</sup>STMicroelectronics (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 (USA)

3:50

IMSE-270

**Focal-plane scale space generation with a 6T pixel architecture**, Fernanda Oliveira<sup>1</sup>, José Gabriel Gomes<sup>1</sup>, Ricardo Carmona-Galán<sup>2</sup>, Jorge Fernández-Berni<sup>2</sup>, and Angel Rodríguez-Vázquez<sup>2</sup>; <sup>1</sup>Universidade Federal do Rio de Janeiro (Brazil) and <sup>2</sup>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)

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, Christoph Hoppe, Nico Peter, 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<sup>1</sup>, L. Natércia Sousa<sup>1</sup>, Nuno Fábio Ferreira<sup>1</sup>, Ricardo M. Sousa<sup>2</sup>, João Santos<sup>2</sup>, Martin Waeny<sup>2</sup>, and Fernando Morgado-Dias<sup>1,3</sup>; <sup>1</sup>Madeira Interactive Technologies Institute, <sup>2</sup>AWAIBA, and <sup>3</sup>University of Madeira (Portugal)

9:10

IMSE-277

**Non-negative Matrix Completion for the enhancement of Snapshot Mosaic Multispectral Imagery**, Grigorios Tsagkatakis<sup>1</sup>, Murali Jayapala<sup>2</sup>, Bert Geelen<sup>2</sup>, and Panagiotis Tsakalides<sup>1</sup>; <sup>1</sup>FORTH (Greece) and <sup>2</sup>IMEC (Belgium)

9:30

IMSE-278

**Trade-off between the number of bits per pixel and motion detection quality for ultra-low power imaging applications**, Camille Dupoirion, Arnaud Verdant, and Gilles Sicard, CEA LETI (France)

9:50

IMSE-279

**Development of an 8K UHD TV demosaicing processor using adaptive interpolation based on local edge magnitude**, Noriyuki Shirai and Yukihiko 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<sup>1</sup>, Klaas Tack<sup>1</sup>, Bert Geelen<sup>1</sup>, Bart Masschelein<sup>1</sup>, Pablo Mateo Aranda Moran<sup>2</sup>, Andy Lambrechts<sup>1</sup>, and Murali Jayapala<sup>1</sup>; <sup>1</sup>Imec and <sup>2</sup>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<sup>1</sup>, Bastien Mamdy<sup>2,3</sup>, and Albert Theuwissen<sup>1,4</sup>; <sup>1</sup>Technische Universiteit Delft (Netherlands), <sup>2</sup>STMicroelectronics (France), <sup>3</sup>Universite Claude Bernard Lyon 1 (France), and <sup>4</sup>Harvest Imaging (Belgium)

11:50

IMSE-283

**Increases in hot pixel development rates for small digital pixel sizes**, Glenn Chapman<sup>1</sup>, Rahul Thomas<sup>1</sup>, Rohan Thomas<sup>1</sup>, Klinsmann Meneses<sup>1</sup>, Tony Yang<sup>1</sup>, Israel Koren<sup>2</sup>, and Zahava Koren<sup>2</sup>; <sup>1</sup>Simon Fraser University (Canada) and <sup>2</sup>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<sup>1</sup>, Sang-Man Han<sup>1</sup>, Hanh Trang<sup>1</sup>, Taishi Takasawa<sup>1</sup>, Satoshi Aoyama<sup>2</sup>, Keita Yasutomi<sup>1</sup>, Keiichiro Kagawa<sup>1</sup>, and Shoji Kawahito<sup>1</sup>; <sup>1</sup>Shizuoka University and <sup>2</sup>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**, Trang Nguyen<sup>1</sup>, Taichi Kasugai<sup>1</sup>, Keigo Isobe<sup>2</sup>, Sang-Man Han<sup>1</sup>, Taishi Takasawa<sup>1</sup>, De Xing Lioe<sup>1</sup>, Keita Yasutomi<sup>1</sup>, Keiichiro Kagawa<sup>1</sup>, and Shoji Kawahito<sup>1</sup>; <sup>1</sup>Shizuoka University and <sup>2</sup>Brookman Technology (Japan)

2:40

3DIPM-050

**Markerless motion capture with multi-view structured light**, Ricardo Garcia and Avidah 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<sup>1</sup>, Eryk Bunsch<sup>2</sup>, Grzegorz Maczkowski<sup>1</sup>, Wojciech Zaluski<sup>1</sup>, Krzysztof Lech<sup>1</sup>, Jakub Michonski<sup>1</sup>, and Jakub Krzeslowski<sup>1</sup>; <sup>1</sup>Warsaw University of Technology and <sup>2</sup>Museum of King Jan III's Palace at Wilanów (Poland)