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# Electronic Imaging

SCIENCE AND TECHNOLOGY

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PROCEEDINGS

## Image Processing: Algorithms and Systems XIV

Editors: **Sos Agaian**, The Univ. of Texas at San Antonio (USA); **Karen Egiazarian**, Tampere University of Technology (Finland);  
and **Atanas Gotchev**, Tampere Univ. of Technology (Finland)

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## Image Processing: Algorithms and Systems XIV

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Damir Sersic, University of Zagreb (Croatia)

## Monday, February 15, 2016

### Image Processing Algorithms

Session Chair: Atanas Gotchev, Tampere University of Technology (Finland)

#### 8:50 – 10:10 am

Golden Gate 4

8:50 IPAS-180

**Combined full-reference image visual quality metrics**, Oleg I. Ieremeiev<sup>1</sup>, Vladimir V. Lukin<sup>1</sup>, Nikolay N. Ponomarenko<sup>1</sup>, Karen O. Egiazarian<sup>2</sup>, and Jaakko Astola<sup>2</sup>; <sup>1</sup>National Aerospace University (Ukraine) and <sup>2</sup>University of Tampere (Finland)

9:10 IPAS-181

**Automatic face anonymization in visual data: Are we really well protected?**, Natacha Ruchaud and Jean-luc Dugelay, Eurecom (France)

9:30 IPAS-182

**Non photorealistic rendering in frequency domain**, Federica Mangiatordi, Emiliano Pallotti, Vittorio Baroncini, and Licia Capodiferro, Fondazione Ugo Bordoni (Italy)

9:50 IPAS-183

**Comparison study of Gaussian mixture models for fingerprints image duplication with new one**, Sos Aghaian<sup>1</sup>, Rushikesh Yeole<sup>1</sup>, Gary Reinecke<sup>2</sup>, Mary Ann<sup>3</sup>, and Mike Troy<sup>3</sup>; <sup>1</sup>University of Texas at San Antonio <sup>2</sup>Boston University, School of Medicine and <sup>3</sup>FlashScan3D (USA)

10:10 – 10:50 am Coffee Break

### Image and Video Processing Algorithms

Session Chair: Karen Egiazarian, Tampere University of Technology (Finland)

#### 10:50 am – 12:10 pm

Golden Gate 4

10:50 IPAS-184

**Image stitching by means of adaptive normalization**, Oleg Michailovich, University of Waterloo (Canada)

4:25 IPAS-193

**Video inpainting of complex scenes based on local statistical model**, V.V.Voronin<sup>1</sup>, R.A. Sizyakin<sup>1</sup>, V.I. Marchuk<sup>1</sup>, Yigang Cen<sup>2</sup>, G.G. Galustov<sup>3</sup>, and K.O. Egiazarian<sup>4</sup>; <sup>1</sup>Don State Technical University (Russian Federation), <sup>2</sup>Beijing Jiaotong University (China) <sup>3</sup>Southern Federal University (Russian Federation) <sup>4</sup>Tampere University of Technology (Finland)

11:30 IPAS-186

**Spatio-temporal video background inpainting**, Petr Pohl, Alexander Malchanov, Artem Shamsuarov, and Victor Bucha, Samsung R&D Institute Russia (Russian Federation)

11:50 IPAS-187

**Video segmentation in presence of static and dynamic textures**, Vladimir Frantc<sup>1</sup>, Sergey Makov<sup>1</sup>, Viacheslav Voronin<sup>1</sup>, Vladimir Marchuk<sup>1</sup>, Sergei Stradanchenko<sup>1</sup>, and Karen Egiazarian<sup>2</sup>; <sup>1</sup>Don State Technical University (Russian Federation) and <sup>2</sup>University of Tampere (Finland)

## Image Processing: Algorithms and Systems XIV

12:10 – 2:00 pm Lunch Break

**El 2016 Opening Plenary and Symposium Awards**

Session Chair: Choon-Woo Kim (Inha University)

**2:00 – 3:00 PM**

Continental Ballroom 5

**Illuminating a bright future for medicine**, Audrey K. Bowden, Stanford University (USA)

3:00 – 3:30 pm Coffee Break

**Image Processing Tools 1**

Session Chair: Sos Agaian, University of Texas at San Antonio (USA)

**3:30 – 4:10 pm**

Golden Gate 4

3:30 IPAS-188  
**Refractory neural nets and vision – a deeper look**, Thomas C. Fall, Kalyx Associates (USA)3:50 IPAS-189  
**Prostate cancer detection using photoacoustic imaging and deep learning**, Arjun Raj Rajanna<sup>1</sup>, Raymond Ptucha<sup>1</sup>, Saugata Sinha<sup>1</sup>, Bhargava Chinni<sup>2</sup>, Vikram Dogra<sup>2</sup>, and Naval Gund A. Rao<sup>1</sup>; <sup>1</sup>Rochester Institute of Technology and <sup>2</sup>University of Rochester (USA)**Image Processing: Algorithms and Systems XIV Interactive Papers Oral Previews I**

Session Chair: Sos Agaian, University of Texas at San Antonio (USA)

**4:10 – 4:30 pm**

Golden Gate 4

In this session interactive poster authors will each provide a brief oral preview of their poster presentation, which will be presented fully in the Image Processing: Algorithms and Systems XIV Interactive Papers Session at 5:30 pm on Wednesday.

4:15 IPAS-191  
**Approximate subgraph isomorphism for image localization**, Vaishaal Vaishaal Shankar, Jordan Zhang, Jerry Chen, Christopher Dinh, Matthew Clements, and Avidesh Zakhor, University of California, Berkeley (USA)4:20 IPAS-192  
**2-D left-side quaternion discrete Fourier transform: Fast algorithm**, Artyom Grigoryan and Sos Agaian, University of Texas at San Antonio (USA)

5:00 – 6:00 pm El 2016 Symposium Reception

**Tuesday, February 16, 2016****DPMI/IPAS: Image Filtering and Denoising** Joint Session

Session Chairs: Karen Egiazarian, Tampere University of Technology (Finland) and Zhen He, Intel Corporation (USA)

**8:50 – 10:10 AM**

Golden Gate 6/7

This session is jointly sponsored by: Digital Photography and Mobile Imaging XII and Image Processing: Algorithms and Systems XIV.

8:50 IPAS-013  
**Intelligent image filtering using multilayer neural network with multi-valued neurons**, Igor Aizenberg, Texas A&M University-Texarkana (USA)9:10 IPAS-014  
**Robust extensions to guided image filtering**, Oleg Michailovich, University of Waterloo (Canada)9:30 DPMI-015  
**Local denoising applied to RAW images may outperform non-local patch-based methods applied to the camera output**, Gabriela Ghimpeanu<sup>1</sup>, Thomas Batard<sup>1</sup>, Tamara Seybold<sup>2</sup>, and Marcelo Bertalmio<sup>1</sup>; <sup>1</sup>University Pompeu Fabra (Spain) and <sup>2</sup>ARRI Arnold & Richter Cine Technik GmbH & Co. Betriebs KG (Germany)9:50 DPMI-016  
**Use of flawed and ideal image pairs to drive filter creation by genetic programming**, Subash Sridhar, Henry Dietz, and Paul Eberhart, University of Kentucky (USA)

10:10 – 10:50 am Coffee Break

**DPMI/IPAS: Color Filter Array Interpolation and Superresolution** Joint Session

Session Chairs: Ajit Bopardikar, Samsung R&amp;D Institute India-Bangalore (India) and Atanas Gotchev, Tampere University of Technology (Finland)

**10:50 am – 12:30 pm**

Golden Gate 6/7

This session is jointly sponsored by: Digital Photography and Mobile Imaging XII and Image Processing: Algorithms and Systems XIV.

10:50 IPAS-024  
**Optimal transparent wavelength and arrangement for multispectral filter array**, Yudai Yanagi<sup>1</sup>, Kazuma Shinoda<sup>1</sup>, Madoka Hasegawa<sup>1</sup>, Shigeo Kato<sup>1</sup>, Masahiro Ishikawa<sup>2</sup>, Hideki Komagata<sup>2</sup>, and Naoki Kobayashi<sup>2</sup>; <sup>1</sup>Utsunomiya University and <sup>2</sup>Saitama Medical University (Japan)11:10 DPMI-025  
**Multi-spectrum to RGB with direct structure-tensor reconstruction**, Takashi Shibata<sup>1,2</sup>, Masayuki Tanaka<sup>1</sup>, and Masatoshi Okutomi<sup>1</sup>; <sup>1</sup>Tokyo Institute of Technology and <sup>2</sup>NEC Corporation (Japan)11:30 IPAS-026  
**Edge-directional interpolation algorithm using structure tensor**, Andrey V. Nasonov<sup>1</sup>, Andrey S. Krylov<sup>1</sup>, Xenyan Yu. Petrova<sup>2</sup>, and Michael N. Rychagov<sup>2</sup>; <sup>1</sup>Lomonosov Moscow State University and <sup>2</sup>Samsung R&D Institute Russia (Russian Federation)11:50 IPAS-027  
**Fast edge-directed single-image super-resolution**, Mushfiqur Rouf<sup>1</sup>, Dikpal Reddy<sup>2</sup>, Kari Pulli<sup>2</sup>, and Rabab Ward<sup>3</sup>; <sup>1</sup>University of British Columbia (Canada) <sup>2</sup>Nvidia Inc, and <sup>3</sup>Light Co (USA)

## Image Processing: Algorithms and Systems XIV

12:10 DPMS-028  
**Light-weight single image super-resolution via pattern-wise regression function**, Kohei Kurihara<sup>1</sup>, Yoshitaka Toyoda<sup>1</sup>, Shotaro Moriya<sup>2</sup>, Daisuke Suzuki<sup>1</sup>, Takeo Fujita<sup>1</sup>, Narihiro Matoba<sup>1</sup>, Jay Thornton<sup>3</sup>, and Fatih Porikli<sup>4</sup>; <sup>1</sup>Mitsubishi Electric Corporation (Japan), <sup>3</sup>Mitsubishi Electric Research Laboratories (MERL) (USA), and <sup>4</sup>Australian National University (Australia)

12:30 – 2:00 pm Lunch Break

### EI 2016 Tuesday Plenary and Symposium Awards

Session Chair: Nitin Sampat (Rochester Institute of Technology)

**2:00 – 3:00 PM**

Continental Ballroom 5

**Pushing computational photography deeper into imaging system design**, Ren Ng, University of California, Berkeley (USA)

3:00 – 3:30 pm Coffee Break

### Image Processing Tools 2

Session Chair: Atanas Gotchev, Tampere University of Technology (Finland)

**3:30 – 4:10 pm**

Golden Gate 4

3:30 IPAS-194  
**Most luminous tetrachromatic surfaces**, Alfredo Restrepo (Palacios) and Edisson Maldonado, Universidad de los Andes (Colombia)

3:50 IPAS-195  
**Zonal-alpha-rooting color image enhancement by the two-side 2D quaternion discrete Fourier transform**, Artyom Grigoryan, Aparna John, and Sos Agaian, University of Texas at San Antonio (USA)

### Image Processing: Algorithms and Systems XIV Interactive Papers Oral Previews II

Session Chair: Atanas Gotchev, Tampere University of Technology (Finland)

**4:10 – 4:40 pm**

Golden Gate 4

In this session interactive poster authors will each provide a brief oral preview of their poster presentation, which will be presented fully in the Image Processing: Algorithms and Systems XIV Interactive Papers Session at 5:30 pm on Wednesday.

4:10 IPAS-196  
**JPEG compression with recursive group coding**, Nadezhda Kozhemiakina<sup>1</sup>, Vladimir V. Lukin<sup>1</sup>, Nikolay N. Ponomarenko<sup>1</sup>, Jaakko Astola<sup>2</sup>, and Karen O. Egiazarian<sup>2</sup>; <sup>1</sup>National Aerospace University (Ukraine) and <sup>2</sup>University of Tampere (Finland)

4:15 IPAS-197  
**Video quality of experience metric for streaming services**, Pradipta Paudyal, Yiwei Liu, Federica Battisti, and Marco Carli, Roma TRE University (Italy)

4:20 IPAS-198  
**Image fusion method for a single sensor based multispectral filter array containing a near infra-red channel**, Seung Hoon Jee and Moon Gi Kang, Yonsei University (South Korea)

4:25 IPAS-199  
**Fréchet MIMO-filters for hyperspectral images**, Valeri Labunets<sup>1</sup> and E. Ostheimer<sup>2</sup>; <sup>1</sup>Ural Federal University (Russian Federation) and <sup>2</sup>Capricat LLC (USA)

4:30 IPAS-200  
**A comparative study of image feature detection and matching algorithms for touchless fingerprint systems**, Sos Agaian, Marzena Mulawka, Rahul Rajendran, Shishir Paramathma Rao, and Shreyas Kamath K.M. and Sriji Rajeev; The University of Texas at San Antonio (USA)

### EI 2016 Symposium Demonstration Session and Exhibit Hall

**Happy Hour**

**5:30 – 7:00 PM**

Continental Ballroom Foyer

## Wednesday, February 17, 2016

### DPMS/IPAS/VIPC: Blur Removal and Synthesis Joint Session

Session Chair: Radka Tezaur, Nikon Research Corp. of America (USA)

**10:50 am – 12:10 pm**

Golden Gate 6/7

This session is jointly sponsored by: Digital Photography and Mobile Imaging XII, Image Processing: Algorithms and Systems XIV, and Visual Information Processing and Communication VII.

10:50 DPMS-030  
**Multi-image sparse motion-invariant photography**, Bart Kofoed<sup>1,2</sup>, Peter de With<sup>1</sup>, and Eric Janssen<sup>2</sup>; <sup>1</sup>Eindhoven University of Technology and <sup>2</sup>Prodrive Technologies (Netherlands)

11:10 DPMS-031  
**Virtual DSLR: High quality dynamic depth-of-field synthesis on mobile platforms**, Yang Yang<sup>1</sup>, Haiting Lin<sup>1</sup>, Zhan Yu<sup>2</sup>, Sylvain Paris<sup>2</sup>, and Jingyi Yu<sup>1</sup>; <sup>1</sup>University of Delaware and <sup>2</sup>Adobe (USA)

11:50 VIPC-033  
**Motion deblurring for depth-varying scenes**, Ruiwen Zhen and Robert Stevenson, University of Notre Dame (USA)

12:10 – 2:00 pm Lunch Break

### EI 2016 Wednesday Plenary and Symposium Awards

Session Chairs: Choon-Woo Kim (Inha University)

**2:00 – 3:00 PM**

Continental Ballroom 5

PLENARY - 001

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

3:00 – 3:30 pm Coffee Break

### EI 2016 Symposium Interactive Papers Session

**5:30 – 7:00 PM**

Continental Ballroom 6

## Image Processing: Algorithms and Systems XIV

**Image Processing: Algorithms and Systems XIV Interactive Papers Session****5:30 – 7:00 pm**

Continental Ballroom 6

The Image Processing: Algorithms & Systems XIV interactive papers will be presented in the EI 2016 Symposium Interactive Papers Session.

**Thursday, February 18, 2016****3DIPM/IPAS: 3D Scene Sensing and Object Recording** Joint Session

Session Chair: Robert Sitnik, Warsaw University of Technology (Poland)

**10:40 am – 12:10 pm**

Golden Gate 6/7

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

10:40

**Joint Session Introduction**

10:50

3DIPM-044

**Shadow detection on 3D point cloud**, Shuyang Sheng and B. Keith Jenkins, University of Southern California (USA)

11:10

3DIPM-045

**Im2Fit: Fast 3D model fitting and anthropometrics using single consumer depth camera and synthetic data**, Qiaosong Wang<sup>1</sup>, Vignesh Jagadeesh<sup>3</sup>, Bryan Ressler<sup>3</sup>, and Robinson Piramuthu<sup>3</sup>; <sup>1</sup>University of Delaware and <sup>3</sup>eBay Research Labs (USA)

11:30

3DIPM-046

**Human detection from still depth images**, Gulsum Can and Helin Dutagaci, Eskisehir Osmangazi University (Turkey)

11: 50

IPAS-047

**Tracking the guitarist's fingers as well as recognizing pressed chords from a video sequence**, Zhao Wang and Jun Ohya, Waseda University (Japan)