Color Imaging XXI: Displaying, Processing, Hardcopy, and Applications

Conference grouping: Image Reproduction and Material Appearance

Conferences in this grouping discuss the effects of extra-spectral attributes; applications of color hard and soft copy: medical imaging, cartography, fine arts, new communications media, knowledge delivery; measurement of Bidirectional Reflectance Distribution Functions (BRDF), Bidirectional Texture Functions (BTF), and Bidirectional Surface Scattering Reflectance Distribution Function (BSSRDF); and quality evaluation of 2.5D and 3D soft- and hardcopy reproductions, among other topics.

Conference overview

Color imaging has historically been treated as a constant phenomenon well described by three independent parameters. Recent advances in computational resources and in the understanding of the human aspects are leading to new approaches that extend the purely metrological view towards a perceptual view of color in documents and displays. Part of this perceptual view is the incorporation of spatial aspects, adaptive color processing based on image content, and the automation of color tasks, to name a few.

This dynamic nature applies to hardcopy devices, but to an even larger extent to soft-copy displays. Adaptive gamut and tone mapping, dynamic contrast, adaptive power usage, and color management continue to support the unprecedented development of the display hardware spreading from mobile displays to large size screens.

This conference provides an opportunity to learn about the most recent developments in color imaging technologies and applications. Focus of the conference is on color image input, dynamic color image output and rendering, color image automation, emphasizing color in context and color in images, and reproduction of images across local and remote devices. The conference covers software, media, and systems. Special attention is given to applications and requirements created by new disciplines.

The Special Session entitled "The Dark Side of Color" groups challenging questions, open issues, alternative views, paradigm shifts, bottom up experimentation, re-addressing the current state of the color science, technology, and applications.

Joint Sessions: Retinex at 50 with the Human Vision and Electronic Imaging (HVEI) Conference

Symposium Chairs: Choon-Woo Kim, Inha University (Korea, the Republic of),**Nitin Sampat,** Rochester Institute of Technology (United States)

Symposium Short Course Chairs: Majid Rabbani, Eastman Kodak Co. (United States), **Mohamed-Chaker Larabi,** University of Poitiers (France)

At-large Conference Chair Representative: Adnan Alattar, Digimarc (United States)

Local Liaison Chair: Joyce Farrell, Stanford University (United States)

Exhibit and Sponsorship Chair: Kevin Matherson, Microsoft Corp. (United States)

Past Symposium Chair: Sheila Hemami, Northeastern University (United States)

Conference Chairs: Reiner Eschbach, National University of Science and Technology (Norway) / Monroe Community College (United States, **Gabriel Marcu,** Apple Inc. (United States), **Alessandro Rizzi,** Università Degli Studi di Milano (Italy)

Conference Committee: Jan Allebach, Purdue University (United States), **Vien Cheung,** University of Leeds (United Kingdom), **Scott Daly,** Dolby Laboratories, Inc. (United States), **Philip Green,** Gjøvik University College (Norway), **Roger Hersch,** École Polytechnique Fédérale de Lausanne (Switzerland), **Choon-Woo Kim,** Inha University (Korea, Republic of), **Michael Kriss,** MAK Consultants (United States), **Fritz Lebowsky,** STMicroelectronics (France), **Nathan Moroney,** Hewlett-Packard Laboratories (United States), **Carinna Parraman,** University of the West of England (United Kingdom), **Marius Pedersen,** Gjøvik University College (Norway), **Shoji Tominaga,** Chiba University (Japan), **Stephen Westland,** University of Leeds (United Kingdom)

Color Imaging XXI: Displaying, Processing, Hardcopy, and Applications

Monday, February 15, 2016

Display

Session Chair: Reiner Eschbach, Monroe Community College (USA)

9:10 – 10:10 am
Continental Ballroom 1

9:10   COLOR-304
Multiprimary display color calibration: A variational framework for robustness to device variation, *Carlos Rodriguez-Pardo and Gaurav Sharma, University of Rochester (USA)*

9:30   COLOR-305
High resolution LED display using a new rendering method with color sub-pixel architecture, *Dae-Sik Kim, Samsung Electronics Co., Ltd. (South Korea)*

9:50   COLOR-306
Modeling of luminance transition curve for transparent displays, *Hyeok Jun Kwon, Chang-Mo Yang, Min-Cheol Kim, and Choon-Woo Kim, Inha University (South Korea)*

10:10 – 10:50 am   Coffee Break

Display & Halftone

Session Chair: Gabriel Marcu (USA)

10:50 am – 12:30 pm
Continental Ballroom 1

10:50   COLOR-307
Developing calibrating curves for trilinear interpolation model during display characterization (JIST-first), *Bangyong Sun[1,2], Jon Yngve Hardeberg[2], and Congjun Cao[1]; [1]Xi'an University of Technology (China) and [2]Gjøvik University College (Norway)*

11:10   COLOR-308
The preferred display color temperature (Non-transparent vs. Transparent display), *Hyeyoung Ha[1], Sooyeon Lee[1], Youngshin Kwak[1], Hyosun Kim[2], Young-jun Seo[2], and Byung-choon Yang[1]; [1]UNIST (South Korea) and [2]Samsung Display Co.,Ltd.*

11:30   COLOR-309
Extended corrected-moments illumination estimation, *Xiaochuan Chen[1], Mark Drew[1], Ze-Nian Li[1], and Graham Finlayson[2]; [1]Simon Fraser University (Canada) and [2]The University of East Anglia (United Kingdom)*

11:50   COLOR-310
Quad-interleaved block-level Parallel Direct Binary Search, *Xujie Zhang[1] and Jan Allebach[2]; [1]Qualcomm Company and [2]Purdue University (USA)*

12:10   COLOR-311
HVS-based model for superposition of two color halftones, *Altyngul Jumabayeva[1], Tal Frank[2], Robert Ulichney3, and Jan Allebach[1]; [1]Purdue University (USA), [2]Hewlett-Packard Indigo Division (Israel), and [3]Hewlett-Packard Laboratories USA (USA)*

12:30 – 2:00 pm   Lunch Break

EI 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

Cameras

Session Chair: Fritz Lebowsky, STMicroelectronics (France)

3:30 – 4:50 pm
Continental Ballroom 1

3:30   COLOR-312
Demosaicking algorithms for different RGBW color filter arrays, *Mina Rafinazari and Eric Dubois, University of Ottawa (Canada)*

3:50   COLOR-313
Optimizing color accuracy of a filter-based multispectral camera via iccMAX framework for digital achieves, *Wei-Chun Hung and Pei-Li Sun, National Taiwan University of Science and Technology (Taiwan)*

4:10   COLOR-314
A learning-based approach to image demosaicking with spatial autocorrelation analysis, *Min-Kook Choi, Chan Joo, Hyun-Gyu Lee, and Sang-Chul Lee, Inha University (South Korea)*

4:30   COLOR-315
On the selection of patches for color camera calibration, *Margarita Khokhlova and Jon Yngve Hardeberg, Gjøvik University College (Norway)*

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

Tuesday, February 16, 2016

COLOR/HVEI: Retinex at 50: History `Joint Session`

Session Chair: Marcelo Bertalmio, Universitat Pompeu Fabra (Spain)

8:50 – 10:10 am
Continental Ballroom 4

This session is jointly sponsored by: Color Imaging XXI: Displaying, Processing, Hardcopy, and Applications, and Human Vision and Electronic Imaging (HVEI) 2016.

8:50   RETINEX-017
Retinexes algorithms: Many spatial processes used to solve many different problems (Invited), *John McCann, McCann Imaging (USA)*

9:30   RETINEX-018
Designator Retinex, Milano Retinex and the locality issue (Invited), *Alessandro Rizzi, Università degli Studi di Milano (Italy)*

10:10 – 10:50 am   Coffee Break

COLOR/HVEI: Retinex at 50: Spatial Algorithms `Joint Session`

Session Chair: John McCann, McCann Imaging (USA)

10:50 am – 12:30 pm
Continental Ballroom 4

This session is jointly sponsored by: Color Imaging XXI: Displaying, Processing, Hardcopy, and Applications, and Human Vision and Electronic Imaging (HVEI) 2016.

10:50　　　　　　　　　　　　　　　　　　RETINEX-019

The oriented difference of Gaussians model of brightness perception (Invited), *Mark McCourt and Barbara Blakeslee, North Dakota State University (USA)*

11:10　　　　　　　　　　　　　　　　　　RETINEX-020

A center-surround framework for spatial image processing, *Vassilios Vonikakis, Advanced Digital Sciences Center (ADSC) (Singapore)*

11:30　　　　　　　　　　　　　　　　　　RETINEX-021

Retinex-like computations in human lightness perception and their possible realization in visual cortex (Invited), *Michael Rudd, University of Washington (USA)*

11:50　　　　　　　　　　　　　　　　　　RETINEX-022

The role of lightness perception in determining the perceived contrast of real world scenes (Invited), *David Kane and Marcelo Bertalmío, Universitat Pompeu Fabra (Spain)*

12:10　　　　　　　　　　　　　　　　　　RETINEX-023

Processing astro photographs using Retinex based methods (Invited), *Daniele Marini, Alessandro Rizzi, and Cristian Bonanomi, Università degli Studi di Milano (Italy)*

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

RETINEX at 50: Image Processing

Session Chair: Alessandro Rizzi, Università degli Studi di Milano (Italy)

3:30 – 5:30 pm
Continental Ballroom 1

3:30　　　　　　　　　　　　　　　　　　RETINEX-316

Connections between Retinex, neural models and variational methods (Invited), *Marcelo Bertalmío, Universitat Pompeu Fabra (Spain)*

4:10　　　　　　　　　　　　　　　　　　RETINEX-317

Image processing applications through a variational perceptually-based color correction related to Retinex (Invited), *Javier Vazquez-Corral[1], Syed Waqas Zamir[1], Adrian Galdran[2], David Pardo[3], and Marcelo Bertalmío[1]; [1]Universitat Pompeu Fabra, [2]Tecnalia, and [3]EHU/UPV and Ikerbasque (Spain)*

4:30　　　　　　　　　　　　　　　　　　RETINEX-318

A generalized white-patch model for fast color cast detection in natural images (Invited), *José Luis Lisani[1], Ana Belen Petro[1], Edoardo Provenzi[2], and Catalina Sbert[1]; [1]Universitat des Illes Balears (Spain) and [2]Université Paris Descartes (France)*

4:50　　　　　　　　　　　　　　　　　　RETINEX-319

Statistical aspects of space sampling in Retinex models (Invited), *Gabriele Gianini, Universitá degli Studi di Milano (Italy)*

5:10

RETINEX Discussion

EI 2016 Symposium Demonstration Session and Exhibit Hall Happy Hour
5:30 – 7:00 PM
Continental Ballroom Foyer

Wednesday, February 17, 2016

Color Management

Session Chair: Phil Green, Gjøvik University College (Norway)

8:50 – 10:10 am
Continental Ballroom 1

8:50　　　　　　　　　　　　　　　　　　COLOR-320

Estimation of color matching function for tiled LCDs based on genetic algorithm, *Yohan Park[1], Chang-Mo Yang[1], Choon-Woo Kim[1], Hosup Lee[2], and Dae-Sik Kim[2]; [1]Inha University and [2]Samsung Electronics. (South Korea)*

9:10　　　　　　　　　　　　　　　　　　COLOR-321

The spatial gamut mapping based on guided filter, *Ming Zhu[1,2], Jon Yngve Hardeberg[2], Na Wang[1], and Bangyong Sun[2]; [1]Henan Institute of Engineering (China) and [2]Gjøvik University College (Norway)*

9:30　　　　　　　　　　　　　　　　　　COLOR-322

Can the problems of CIECAM02 be overcome without losing predicting accuracy?, *Zhifeng Wang[1], Zhiqiang Li[2], Ming Luo[3], Xuedong Zhang[4], and Changjun Li[5]; [1]University of Science and Technology Liaoning (China) and [3]University of Leeds (United Kingdom)*

9:50　　　　　　　　　　　　　　　　　　COLOR-323

A color retargeting approach for mesopic vision: simulation and compensation (JIST-first), *Mehdi Rezagholizadeh[1], Tara Akhavan[2], Afsoon Soudi[3], Hannes Kaufmann[2], and James Clark[4]; [1]McGill University (Canada), [2]Vienna University of Technology (Austria), and [3]TandemLaunch Inc. (Canada)*

10:10 – 10:40 am　　　　Coffee Break

Color Deficiency

Session Chair: Alessandro Rizzi, Università degli Studi di Milano (Italy)

10:40 am – 12:40 pm
Continental Ballroom 1

10:40　　　　　　　　　　　　　　　　　　COLOR-324

Using a data-bearing frame to capture an extended target, *Robert Ulichney, Matthew Gaubatz, Chun-Jung Tai, Stephen Pollard, Melanie Gottwals, and Ingeborg Tastl, Hewlett-Packard, Inc (USA)*

11:00   COLOR-325
A new approach to image enhancement for the visually impaired,
*Xiaohong Gao[1] and Monica Loomes[2]; [1]Middlesex University and
[2]Hertfordshire County Council (United Kingdom)*

11:20   COLOR-326
Quality of color coding in maps for color deficient observers, *Anne
Kristin Kvitle, Marius Pedersen, and Peter Nüssbaum, Gjøvik University
College (Norway)*

11:40   COLOR-327
**Image quality assessment comparison between local and whole color
rendering on large displays,** *YoonJung Kim, Daeun Park, and YungKyung
Park, Ewha Womans University (South Korea)*

12:00   COLOR-328
Colour vision deficiency transforms using ICC profiles, *Phil Green and
Peter Nussbaum, Gjøvik University College (Norway)*

12:20   COLOR-329
Color appearance simulations using spectral estimation theory, *Haomiao
Jiang, Trisha Lian, Brian Wandell, and Joyce Farrell, Stanford University (USA)*

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

The Dark Side of Color
Session Chair: Reiner Eschbach, Monroe Community College (USA)
3:30 – 5:30 pm
Continental Ballroom 1

3:30   COLOR-330
How red is cadmium red?, *Carinna Parraman[1] and Judith Mottram[2];
[1]University of the West of England and [2]Royal College of Art (United
Kingdom)*

3:50   COLOR-331
**Contentious and discrete spectral power distributions: Which is a
better white light source?,** *Po-Chieh Hung, Konica Minolta, Inc. (Japan)*

4:10   COLOR-332
**Color management breaks good anaglyph 3D images – is there a
solution?,** *Andrew Woods, Curtin University (Australia)*

4:30   COLOR-333
**New dimension of color perception: From artistic expression to
scientific analysis,** *Larissa Noury[2] and Christine Fernandez Maloigne[1,3,4];
[1]XLIM, [2]Couleur-Espace-Culture, [3]University of Poitiers, and [4]CNRS (France)*

4:50   COLOR-334
The murkiness of image quality assessment, *Marius Pedersen, Gjøvik
University College (Norway)*

5:10   COLOR-335
For each country, a color of lipstick, *Christine Fernandez Maloigne[1,2,3];
[1]University of Poitiers, [2]XLIM lab, and [3]CNRS (France)*

**Color Imaging XXI: Displaying, Processing, Hardcopy, and Applications
Interactive Papers Session**

5:30 – 7:00 pm
Continental Ballroom 6

The following works will be presented at the EI 2016 Symposium Interac-
tive Papers Session.

                                                          COLOR-336
Color vision testing using the Oculus Rift, *Trisha Lian, Haomiao Jiang,
and Joyce Farrell, Stanford University (USA)*

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

Thursday, February 18, 2016

Color in Medical Applications

Session Chair: Daniele Marini, Università degli Studi di Milano (Italy)

9:10 – 10:10 am
Continental Ballroom 1

9:10   COLOR-337
**Optical imaging techniques for non-contact measurements of vital functions
and diagnosis of malignant tissues in medicine,** *Rudolf Verdaasdonk, John
Klaessens, and Albert Veen, VU University Medical Center (Netherlands)*

9:30   COLOR-338
Characterisation of skin spectra in a Caucasian and Oriental sample,
*Kaida Xiao[3,2], Mengmeng Wang[1], Ming Luo[1], Changjun Li[3], and
Sophie Wuerger[2]; [1]University of Leeds, [2]University of Liverpool (United
Kingdom), and [3]University of Science and Technology Liaoning (China)*

9:50   COLOR-339
Current problems and perspectives on colour in medical imaging,
*William Revie[1] and Phil Green[2]; [1]FFEI (United Kingdom) and [2]Gjøvik
University College (Norway)*

10:10 – 10:50 am   Coffee Break

Printing

Session Chair: Carinna Parraman, University of the West of England
(United Kingdom)

10:50 am – 12:30 pm
Continental Ballroom 1

10:50   COLOR-340
Dynamic print stream classification and optimal JPEG compression,
*Cheng Lu[1], Mark Shaw[2], Randy Guay[2], David Day[2], and Jan Allebach[1];
[1]Purdue University and [2]Hewlett Packard (USA)*

11:10   COLOR-341
Toner usage prediction, *Mengqi Gao[2], Yanling Ju[1], Terry Nelson[3],
Theresa Prenn[3], and Jan Allebach[1]; [2]Purdue University and [3]Hewlett-Parkard
Co. (USA)*

11:30   COLOR-342

Color uniformity improvement for an inkjet color 3D printing system, *Pei-Li Sun and Yuping Sie, National Taiwan University of Science and Technology (Taiwan)*

11:50   COLOR-343

Vector driven 2.5D printing with non-photorealistic rendering, *Paul O'Dowd, Carinna Parraman, and Mikaela Harding, University of the West of England (United Kingdom)*

12:10   COLOR-344

2.5D printing: The evolution of the water lily, *Carinna Parraman, Paul O'Dowd, and Mikaela Harding, University of the West of England (United Kingdom)*

12:30 – 2:00 pm   Lunch Break

Invited Talk: Vision Security - The Role of Imaging
Session Chair: Alessandro Rizzi, Università degli Studi di Milano (Italy)
2:00 – 2:30 pm
Continental Ballroom 1

COLOR-345

Vision security – the role of imaging, *Marius Pedersen and Jon Yngve Hardeberg, Gjøvik University College (Norway)*

Vision & Image Processing

Session Chair: Marius Pedersen, Gjøvik University College (Norway)

2:30 – 5:10 pm
Continental Ballroom 1

2:30   COLOR-346

Psychophysical study of color verbalization using fuzzy logic, *Corey Abshire[1], Jan Allebach[2], and Dmitri Gusev[3]; [1]Indiana University and [2]Purdue University (USA)*

2:50   COLOR-347

Lightness perception for different size displays under various surround conditions, *YungKyung Park[1], Hyosun Kim[2], Young-jun Seo[2], and YoonJung Kim[1]; [1]Ewha Womans University and [2]Samsung Display Co. Ltd. (South Korea)*

3:10   COLOR-348

Enhancement of perceived sharpness by chroma contrast, *YungKyung Park and YoonJung Kim, Ewha Womans University (South Korea)*

3:30   COLOR-349

Choice of distance metrics for RGB color image analysis, *Amadou Tidjani Sanda Mahama[1], Augustin Dossa[1], and Pierre Gouton[2]; [1]Institut de Mathématiques et de Sciences Physiques (Benin) and [2]Université de Bourgogne (France)*

3:50   COLOR-350

Digital image segmentation for object-oriented halftoning, *Zuguang Xiao[1], Mengqi Gao[1], Brent Bradburn[2], and Jan Allebach[1]; [1]Purdue University and [2]Hewlett-Packard (USA)*

4:10   COLOR-351

How suitable is structure tensor analysis for real-time color image compression in context of high quality display devices, *Fritz Lebowsky and Mariano Bona, STMicroelectronics (France)*

4:30   COLOR-352

Preserving color fidelity in real-time color image compression using a ranking naturalness criterion, *Marina Nicolas and Fritz Lebowsky, STMicroelectronics (France)*

4:50   COLOR-353

Multiscale approach for dehazing using the STRESS framework (JIST-first), *Vincent Jacob Whannou de Dravo and Jon Yngve Hardeberg; The Norwegian Colour and Visual Computing Laboratory, Gjøvik University College (Norway)*