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PROCEEDINGS

Image Quality and System Performance XVIII

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Mylène Farias, University of Brasilia (Brazil)

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Image Quality and System Performance XVIII

Conference overview

We live in a visual world. The perceived quality of images is of crucial importance in industrial, medical, and entertainment application environments. Developments in camera sensors, image processing, 3D imaging, display technology, and digital printing are enabling new or enhanced possibilities for creating and conveying visual content that informs or entertains. Wireless networks and mobile devices expand the ways to share imagery and autonomous vehicles bring image processing into new aspects of society.

The power of imaging rests directly on the visual quality of the images and the performance of the systems that produce them. As the images are generally intended to be viewed by humans, a deep understanding of human visual perception is key to the effective assessment of image quality.

This conference brings together engineers and scientists from industry and academia who strive to understand what makes a high-quality image, and how to specify the requirements and assess the performance of modern imaging systems. It focuses on objective and subjective methods for evaluating the perceptual quality of images, and includes applications throughout the imaging chain from image capture, through processing, to output, printed or displayed, video or still, 2D or 3D, virtual, mixed or augmented reality, LDR or HDR.

Conference Chairs: Mylène Farias, University of Brasilia (Brazil), and Mohamed-Chaker Larabi, University of Poitiers (France)

Program Committee: Nicolas Bonnier, Apple Inc. (United States); Alan Bovik, University of Texas at Austin (United States); Peter Burns, Burns Digital Imaging (United States); Anustup Choudhury, Dolby Laboratories (United States); Brian Cooper, Lexmark International, Inc. (United States); Luke Cui, Amazon (United States); Mylène Farias, University of Brasilia (Brazil); Susan Farnand, Rochester Institute of Technology (United States); Frans Gaykema, Océ Technologies B.V. (the Netherlands); Jukka Häkkinen, University of Helsinki (Finland); Dirk Hertel, E Ink Corporation (United States); Robin Jenkin, NVIDIA Corporation (United States); Elaine Jin, NVIDIA Corporation (United States); Göte Nyman, University of Helsinki (Finland); Jonathan Phillips, Google Inc. (United States); and Sophie Triantaphillidou, University of Westminster (United Kingdom)

Paper authors listed as of 1 January 2021; refer to manuscript for final authors. Titles that are not listed with the proceedings files were presentation-only.

Image Quality and System Performance XVIII

TUESDAY 19 JANUARY 2021

PLENARY: DEEP INTERNAL LEARNING—DEEP LEARNING WITH ZERO EXAMPLES

Session Chair: Charles Bouman, Purdue University (United States)

10:00 – 11:10

Deep internal learning—Deep learning with zero examples

Michal Irani, professor, Department of Computer Science and Applied Mathematics, Weizmann Institute of Science (Israel)

Michal Irani is a professor at the Weizmann Institute of Science. Her research interests include computer vision, AI, and deep learning. Irani's prizes and honors include the Maria Petrou Prize (2016), the Helmholtz "Test of Time Award" (2017), the Landau Prize in AI (2019), and the Rothschild Prize in Mathematics and Computer Science (2020). She also received the ECCV Best Paper Awards (2000 and 2002), and the Marr Prize Honorable Mention (2001 and 2005).

THURSDAY 21 JANUARY 2021

PLENARY: THE DEVELOPMENT OF INTEGRAL COLOR IMAGE SENSORS AND CAMERAS

Session Chair: Jonathan B. Phillips, Google Inc. (United States)

10:00 – 11:10

The development of integral color image sensors and cameras

Kenneth A. Parulski, expert consultant: mobile imaging (United States)

Kenneth Parulski is an expert consultant to mobile imaging companies and leads the development of ISO standards for digital photography. He joined Kodak in 1980 after graduating from MIT and retired in 2012 as research fellow and chief scientist in Kodak's digital photography division. His work has been recognized with a Technical Emmy and other major awards. Parulski is a SMPTE fellow and an inventor on more than 225 US patents.

MONDAY 25 JANUARY 2021

PLENARY: MAKING INVISIBLE VISIBLE

Session Chair: Jonathan B. Phillips, Google Inc. (United States)

10:00 – 11:10

Making invisible visible

Ramesh Raskar, *associate professor, MIT Media Lab (United States)*

Ramesh Raskar is an associate professor at MIT Media Lab and directs the Camera Culture research group. His focus is on AI and imaging for health and sustainability. They span research in physical (e.g., sensors, health-tech), digital (e.g., automated and privacy-aware machine learning), and global (e.g., geomaps, autonomous mobility) domains. He received the Lemelson Award (2016), ACM SIGGRAPH Achievement Award (2017), DARPA Young Faculty Award (2009), Alfred P. Sloan Research Fellowship (2009), TR100 Award from MIT Technology Review (2004), and Global Indus Technovator Award (2003). He has worked on special research projects at Google [X] and Facebook and co-founded/advised several companies.

SYSTEM PERFORMANCE I

Moderator: Sophie Triantaphillidou, University of Westminster (United Kingdom) / **Session Chairs:** Peter Burns, Burns Digital Imaging (United States) and Mylène Farias, University of Brasilia (Brazil)

11:40 – 13:00

11:40

IQSP-215

Evaluation of the lens flare, *Elodie Souksava^{1,2}, Thomas Corbier¹, Alexandra Giraua^{1,3}, François-Xavier Thomas¹, Laurent Chanas¹, and Frédéric Guichard¹; ¹DxOMark Image Labs, ²Sorbonne Université, and ³Institut d'Optique Graduate School (France)*

12:00

IQSP-216

Corner cases and limitations using a DOE based geometric camera calibration, *Dietmar Wueller, Image Engineering GmbH & Co. KG (Germany)*

12:20

IQSP-217

Using images of noise to estimate image processing behavior for image quality evaluation, *Norman Koren, Imatest LLC (United States)*

12:40

IQSP-218

RAW image quality evaluation using information capacity, *François-Xavier Thomas, Thomas Corbier, Emilie Baudin, Yiqi Li, Laurent Chanas, and Frédéric Guichard, DxOMark Image Labs (France)*

CONFERENCE INTERACTIVE POSTER

13:00 – 13:30

IQSP-196

IQSP POSTER: Understanding the importance of artistic aspect of camera image quality tuning and quantifying the artistic attributes by using scientific principles, *Vickrant Zunjarrao, Ranga Burada, Sharvin Shobhane, and Lekha Lokhande, Microsoft Corporation (United States)*

INDUSTRY PERSPECTIVES ON MOBILE IMAGE QUALITY I

Moderator: Susan Farnand, Rochester Institute of Technology (United States) / **Session Chairs:** Elaine Jin, Intuitive Surgical (United States) and Sophie Triantaphillidou, University of Westminster (United Kingdom)

13:30 – 14:30

13:30 IQSP-203
From the beginning until now - Twenty years of subjective mobile phone camera photography and image quality development (Invited), Tero Vuori, Xiaomi (Finland)

Invited speaker Tero Vuori is senior manager, camera and image quality at Xiaomi Technology, Tampere, Finland. Vuori is a camera and imaging professional with 20 years' experience in imaging and camera engineer and manager positions in companies like Nokia, Microsoft, Intel, and Xiaomi. He is a successful contributor as IQ tech lead, team lead, IQ architect, engineering manager, camera engineer, scrum master, and product owner. His background includes IQ testing architectures for R&D milestones in camera and imaging systems (sensors, optics, camera modules, ISP pipes, 3A, algorithms, and camera IQ tunings) and multiple IQ testing standards and test procedures widely used in the digital camera industry.

13:50 IQSP-204
VCX Version 2020 – Further development of a transparent and objective evaluation scheme for mobile phone cameras, Uwe Artmann, Image Engineering GmbH & Co KG (Germany)

14:10 IQSP-205
The gaps between development and research in mobile image processing (Invited), Artem Zinevich, Amazon Lab126 (United States)

Invited speaker Artem Zinevich, PhD, is a principal engineer - video quality with Amazon Lab126 in Sunnyvale, CA. Zinevich is currently specializing in digital imaging, and has contributed in a variety of domains - market-leading digital image processors, speech recognition, first of its kind monitoring of atmosphere via cellular networks, and seismic signal processing. His specialties include imaging systems, image signal processors (ISPs) - architecture & algorithms, still and video cameras, image sensors; machine learning and speech recognition, software (C/C++, Matlab, Python, Perl, embedded, scripting, etc.); and team building and leadership, project and program management, critical chain and agile, product ownership, and customer relations.

INDUSTRY PERSPECTIVES ON MOBILE IMAGE QUALITY II

Moderator: Stuart Perry, University of Technology Sydney (Australia) / **Session Chairs:** Brian Cooper, Lexmark (United States) and Elaine Jin, Intuitive Surgical (United States)

18:15 – 19:15

18:15 IQSP-206
Camera image quality tradeoff processing of image sensor re-mosaic using deep neural network, Younghoon Kim, Jungmin Lee, Sung-su Kim, Jiyun Bang, Dageum Hong, TaeHyung Kim, and JoonSeo Yim, Samsung Electronics (Republic of Korea)

18:35 IQSP-207
MIPI camera: Opportunities, challenges, and solutions for Chromebook cameras (Invited), Fei Wu, Google Inc. (United States)

Invited speaker Fei Wu is an engineer at Google, Inc., working in the areas of machine learning, deep learning, computer vision, and neural-linguistic programming (NLP).

18:55
IQSP Discussion

CONFERENCE INTERACTIVE POSTERS

IQSP-197
IQSP POSTER: Automatic image quality tuning framework for optimization of ISP parameters based on multi-stage optimization approach, Pavithra G and Radhesh Bhat, PathPartner Technology Pvt Ltd (India)

IQSP POSTER: Quantitative image quality evaluation method for UDC (under display camera), *Sungho Cha, Samsung Electronics (Republic of Korea)*

SYSTEM PERFORMANCE II

Moderator: Luke Cui, Amazon (United States) / **Session Chairs:** Susan Farnand, Rochester Institute of Technology (United States) and Stuart Perry, University of Technology Sydney (Australia)

19:45 – 20:25

19:45

IQSP-219

Experimental study for revising visual noise measurement of ISO 15739, *Akira Matsui¹, Naoya Katoh¹, and Dietmar Wueller²; ¹Sony Imaging Products & Solutions Inc. (Japan) and ²Image Engineering GmbH & Co. KG (Germany)*

20:05

IQSP-220

A new PDAF correction method of CMOS image sensor with Nonacell and Super PD to improve image quality in binning mode, *Yeongheup Jang, Samsung Electronics (Republic of Korea)*

TUESDAY 26 JANUARY 2021

VISUAL QUALITY METRICS I

Moderator: Jukka Häkkinen, University of Helsinki (Finland)

Session Chairs: Mohamed Chaker Larabi, Université de Poitiers (France) and Sophie Triantaphillidou, University of Westminster (United Kingdom)

10:15 – 11:15

10:15

IQSP-261

Analyzing the effect of adding temporal features to an autoencoder-based video quality model, *André Costa¹, Helard Martinez², Daniel Silva¹, and Mylène Farias¹; ¹Universidade de Brasilia (Brazil) and ²University College Dublin (Ireland)*

10:35

IQSP-262

A comprehensive analysis of crowdsourcing for subjective evaluation of tone mapping operators, *Ali Ak¹, Abhishek Goswami^{2,3}, Wclf Hauser³, Patrick Le Calle¹, and Frederic Dufaux²; ¹Universite de Nantes, ²Centre National de la Recherche Scientifique, and ³DxO Labs (France)*

10:55

IQSP-263

Quality is in the salient region of the image, *Meisam Jamshidi Seikavandi¹ and Seyed Ali Amirshahi²; ¹Loresan Technology and Science Park (Iran) and ²Norwegian University of Science and Technology (Norway)*

VISUAL QUALITY METRICS II

Moderator: Peter Burns, Burns Digital Imaging (United States) / **Session Chairs:** Nicolas Bonnier, Apple Inc. (United States) and Sophie Triantaphillidou, University of Westminster (United Kingdom)

11:45 – 12:45

11:45 IQSP-264
Enhancement of pixel-based video quality models using meta-data, *Rakesh Rao Ramachandra Rao, Steve Göring, and Alexander Raake, Technische University Ilmenau (Germany)*

12:05 IQSP-265
No-reference image quality assessment of underwater images using multi-scale salient local binary patterns, *Muhammad Irshad¹, Camilo Sanchez Ferreira², Sana Alamgeer¹, Carlos H. Llanos¹, and Mylène Farias¹; ¹University of Brasilia (Brazil) and ²Universidad del Cauca (Colombia)*

12:25 IQSP-266
Exploring the boundaries of an AE-based quality model: A performance analysis via synthetic content, *Helard Becerra¹, Bruna Azambuja², André Costa², Andrew Hines¹, and Mylène Farias²; ¹University College Dublin (Ireland) and ²Universidade de Brasilia (Brazil)*

CONFERENCE INTERACTIVE POSTERS

12:45 – 13:15

IQSP-224
IQSP POSTER: Neural network-based assessment of the impact induced in video quality assessment by the semantic labels, *Celestin Hernandez, Zacharie De La Lande Dolce, Rania Bensaïed, and Mihai Mitrea, Institut Mines-Telecom (France)*

IQSP-225
IQSP POSTER: Saliency-based deep blind image quality assessment, *Kamal Lamichhane¹, Marco Carli¹, and Federica Battisti²; ¹Università degli Studi Roma TRE and ²University of Padova (Italy)*

QUALITY OF IMMERSIVE APPLICATIONS I

Moderator: Mohamed Chaker Larabi, Université de Poitiers (France)

Session Chairs: Peter Burns, Burns Digital Imaging (United States) and Mylène Farias, University of Brasilia (Brazil)

13:15 – 14:15

13:15 IQSP-255
A content-based viewport prediction model, *Dario Morais¹, Lucas Althof¹, Ravi Prakash², Marcelo Carvalho¹, and Mylène Farias¹; ¹Universidade de Brasilia (Brazil) and ²The University of Texas at Dallas (United States)*

13:35 IQSP-256
A novel point cloud quality assessment metric based on perceptual color distance patterns, *Rafael Diniz, Mylène Farias, and Pedro Garcia Freitas, Universidade de Brasilia (Brazil)*

13:55 IQSP-257
A deep perceptual metric for 3D point clouds, *Maurice Quach¹, Aladine Chetouani^{1,2}, Giuseppe Valenzise¹, and Frederic Dufaux¹; ¹Universite Paris-Saclay and ²University of Orléans (France)*

WEDNESDAY 27 JANUARY 2021

PLENARY: REVEALING THE INVISIBLE TO MACHINES WITH NEUROMORPHIC VISION SYSTEMS: TECHNOLOGY AND APPLICATIONS OVERVIEW

Session Chair: Radka Tezaur, Intel Corporation (United States)

10:00 – 11:10

Revealing the invisible to machines with neuromorphic vision systems: Technology and applications overview
Luca Verre, CEO and co-founder, Prophesee (France)

Luca Verre is co-founder and CEO of Prophesee, the inventor of the world's most advanced neuromorphic vision systems. Verre is a World Economic Forum technology pioneer. His experience includes project and product management, marketing, and business development roles at Schneider Electric. Prior to Schneider Electric, Verre worked as a research assistant in photonics at the Imperial College of London. Verre holds a MSc in physics, electronic and industrial engineering from Politecnico di Milano and Ecole Centrale and an MBA from Institut Européen d'Administration des Affaires, INSEAD.

QUALITY OF IMMERSIVE APPLICATIONS II

Moderator: Mylène Farias, University of Brasilia (Brazil)

Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Mohamed Chaker Larabi, Université de Poitiers (France)

11:40 – 13:00

11:40 IQSP-294
Effectiveness of VR immersive applications for public speaking enhancement, Arianna Notaro, Fabio Capraro, Marco Pesavento, Simone Milani, and Maria Grazia Busà, Università degli Studi di Padova (Italy)

12:00 IQSP-295
Quality assessment of super-resolved omnidirectional image quality using tangential views, Cagri Ozcinar¹ and Aakanksha Rana²; ¹Samsung Research UK (United Kingdom) and ²Massachusetts Institute of Technology (United States)

12:20 IQSP-296
On the influence of head-mounted displays on visual quality rating, Aberrezzaq Sendjasni and Mohamed Chaker Larabi, Université de Poitiers (France)

12:40 IQSP-297
No-reference stereoscopic image quality predictor using deep features from cyclopean image, Oussama Messai¹, Aladine Chetouan², Fella Hachout¹, and Zianou Ahmed Seghir³; ¹University of Mentouri Brothers Constantine 1 (Algeria), ²University of Orléans (France), and ³University of Abbes Laghrour (Algeria)

KEYNOTE: QUALITY OF IMMERSIVE APPLICATIONS

Session Chairs: Peter Burns, Burns Digital Imaging (United States) and Mylène Farias, University of Brasilia (Brazil)

Moderator: Mohamed Chaker Larabi, Université de Poitiers (France)

13:30 – 14:30

IQSP-278

KEYNOTE: Quality of visual immersion: The point clouds perspective, *Fernando Pereira, Instituto Superior Técnico - Instituto de Telecomunicações (Portugal)*

Keynote speaker Fernando Pereira is currently a professor at Instituto Superior Técnico, Universidade de Lisboa, and a senior researcher at Instituto de Telecomunicações, Lisbon, Portugal. He was an IEEE Distinguished Lecturer in 2005 and was elected as an IEEE Fellow in 2008 for "contributions to object-based digital video representation technologies and standards". He was elected to serve on the Signal Processing Society Board of Governors in the capacity of Member-at-Large for a 2012 and a 2014-2016 term. Since January 2018, he is the SPS vice-president for conferences. Since 2013, he is also a EURASIP Fellow for "contributions to digital video representation technologies and standards". He was elected to serve on the European Signal Processing Society Board of Directors for a 2015-2018 term. Since 2015, he is also a IET Fellow. He was the MPEG Requirements Chair from 2002 to 2007 and has been the JPEG Requirements Chair since February 2016. He was the general chair of the Picture Coding Symposium (PCS) in 2007, the technical program co-chair of the Int. Conference on Image Processing (ICIP) in 2010 and 2016, the technical program chair of the International Workshop on Image Analysis for Multimedia Interactive Services (VIAMIS) in 2008 and 2012, and the general chair of the International Conference on Quality of Multimedia Experience (QoMEX) in 2016. He has contributed more than 300 papers in international journals, conferences, and workshops, and made numerous invited talks at conferences and workshops. His areas of interest are visual data analysis, coding, description, adaptation, and quality assessment, in the context of advanced multimedia services.