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Imaging Quality and System Performance XX

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Image Quality and System Performance XX

MONDAY 16 JANUARY 2023

20th Anniversary: A Tour of Quality Assessment and System Performance (M1)
Session Chair: Mohamed Chaker Larabi, Université de Poitiers (France)
8:45 – 10:20 AM
Cyril Magnin III

8:45
Conference Welcome, Chaker Larabi

8:50
Twenty years in twenty minutes, Peter Burns

9:10 N/A
Subjective image quality: Beauty and the Beast in human vision (Invited), *Göte S. Nyman, University of Helsinki (Finland)*

9:45 N/A
Displays and lighting: What do they have in common? (Invited), *Ingrid Heynderickx, Eindhoven University of Technology (the Netherlands)*

20th Anniversary: A Tour of Quality Assessment and System Performance (M2)
Session Chairs: Mohamed Chaker Larabi, Université de Poitiers (France) and Jonathan Phillips, Imatest, LLC (United States)
10:40 AM – 12:30 PM
Cyril Magnin III

10:40 N/A
The revolutionary advancement of camera phone image quality (Invited), *Jonathan Phillips, Imatest, LLC (United States)*

11:10 N/A
23 years of ISO 12233 resolution measurement (Invited), *Dietmar Wueller, Image Engineering GmbH & Co. KG (Germany)*

11:20 N/A
Limits of MTF in practice (Invited), *Alexander Braun, Düsseldorf University of Applied Sciences (Germany)*

11:30 N/A
Measuring camera information capacity with slanted-edges (Invited), *Norman Koren, Imatest LLC (United States)*

11:40 N/A
From BxU to integrated information capacity, a brief history of MTF based KPIs at DXOMARK (Invited), *Laurent Chanas, DxOMark Image Labs (France)*

11:50
Panel Discussion

Monday 16 January PLENARY: Neural Operators for Solving PDEs
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Deep learning surrogate models have shown promise in modeling complex physical phenomena such as fluid flows, molecular dynamics, and material properties. However, standard neural networks assume finite-dimensional inputs and outputs, and hence, cannot withstand a change in resolution or discretization between training and testing. We introduce Fourier neural operators that can learn operators, which are mappings between infinite dimensional spaces. They are independent of the resolution or grid of training data and allow for zero-shot generalization to higher resolution evaluations. When applied to weather forecasting, neural operators capture fine-scale phenomena and have similar skill as gold-standard numerical weather models for predictions up to a week or longer, while being 4-5 orders of magnitude faster.

Anima Anandkumar, Bren professor, California Institute of Technology, and senior director of AI Research, NVIDIA Corporation (United States)

Anima Anandkumar is a Bren Professor at Caltech and Senior Director of AI Research at NVIDIA. She is passionate about designing principled AI algorithms and applying them to interdisciplinary domains. She has received several honors such as the IEEE fellowship, Alfred. P. Sloan Fellowship, NSF Career Award, and Faculty Fellowships from Microsoft, Google, Facebook, and Adobe. She is part of the World Economic Forum's Expert Network. Anandkumar received her BTech from Indian Institute of Technology Madras, her PhD from Cornell University, and did her postdoctoral research at MIT and assistant professorship at University of California Irvine.

Subjective Quality Assessment (M3)
Session Chair: Sophie Triantaphillidou, University of Westminster (United Kingdom)
3:30 – 4:50 PM
Cyril Magnin III

3:30 IQSP-301
Image demosaicing: Subjective analysis and evaluation of image quality metrics, *Tawsin Uddin Ahmed, Seyed Ali Amirshahi, and Marius Pedersen, Norwegian University of Science and Technology (Norway)*

3:50 IQSP-302
Age-specific perceptual image quality assessment, *Yinan Wang[1], Andrei Chubarau[1], Tara Akhavan[2], Hyunjin Yoo[2], and James Clark[1]; [1]McGill University and [2]Forvia (Canada)*

4:10 IQSP-303
A method for evaluating camera auto-focusing performance using a transparent display device, *Seungwan Jeon, Kichul Park, Sung-Su Kim, and Yitae Kim, Samsung Electronics (Republic of Korea)*

EI 2023 Highlights Session
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
3:30 – 5:00 PM
Cyril Magnin II

Join us for a session that celebrates the breadth of what EI has to offer with short papers selected from EI conferences.

NOTE: The EI-wide "EI 2023 Highlights" session is concurrent with Monday afternoon COIMG, COLOR, IMAGE, and IQSP conference sessions.

N/A
Evaluation of image quality metrics designed for DRI tasks with automotive cameras, *Valentine Klein, Yiqi LI, Claudio Greco, Laurent Chanas, and Frédéric Guichard, DXOMARK (France)*

N/A
Human performance using stereo 3D in a helmet mounted display and association with individual stereo acuity, *Bonnie Posselt, RAF Centre of Aviation Medicine (United Kingdom)*

N/A
Smartphone-enabled point-of-care blood hemoglobin testing with color accuracy-assisted spectral learning, *Sang Mok Park[1], Yuhyun Ji[1], Semin Kwon[1], Andrew R. O'Brien[2], Ying Wang[2], and Young L. Kim[1]; [1]Purdue University and [2]Indiana University School of Medicine (United States)*

N/A
Designing scenes to quantify the performance of automotive perception systems, *Zhenyi Liu[1], Devesh Shah[2], Alireza Rahimpour[2], Joyce Farrell[1], and Brian Wandell[1]; [1]Stanford University and [2]Ford Motor Company (United States)*

N/A
Visualizing and monitoring the process of injection molding, *Christian A. Steinparz[1], Thomas Mitterlehner[2], Bernhard Praher[2], Klaus Straka[1,2], Holger Stitz[1,3], and Marc Streit[1,3]; [1]Johannes Kepler University, [2]Moldsonics GmbH, and [3]datavisyn GmbH (Austria)*

N/A
Commissioning the James Webb Space Telescope, *Joseph M. Howard, NASA Goddard Space Flight Center (United States)*

N/A

Critical flicker frequency (CFF) at high luminance levels, *Alexandre Chapiro[1], Nathan Matsuda[1], Maliha Ashraf[2], and Rafal Mantiuk[3]; [1]Meta (United States), [2]University of Liverpool (United Kingdom), and [3]University of Cambridge (United Kingdom)*

N/A

Physics guided machine learning for image-based material decomposition of tissues from simulated breast models with calcifications, *Muralikrishnan Gopalakrishnan Meena[1], Amir K. Ziabari[1], Singanallur Venkatakrishnan[1], Isaac R. Lyngaas[1], Matthew R. Norman[1], Balint Joo[1], Thomas L. Beck[1], Charles A. Bouman[2], Anuj Kapadia[1], and Xiao Wang[1]; [1]Oak Ridge National Laboratory and [2]Purdue University (United States)*

N/A

Layered view synthesis for general images, *Loïc Dehan, Wiebe Van Ranst, and Patrick Vandewalle, Katholieke University Leuven (Belgium)*

N/A

A self-powered asynchronous image sensor with independent in-pixel harvesting and sensing operations, *Ruben Gomez-Merchan, Juan Antonio Leñero-Bardallo, and Ángel Rodríguez-Vázquez, University of Seville (Spain)*

N/A

Color blindness and modern board games, *Alessandro Rizzi[1] and Matteo Sassi[2]; [1]Università degli Studi di Milano and [2]consultant (Italy)*

TUESDAY 17 JANUARY 2023

KEYNOTE: Perceptual Video Quality 1 (T1) Joint Session

Session Chairs: Lukáš Krasula, Netflix, Inc. (United States) and Mohamed Chaker Larabi, Université de Poitiers (France)
9:05 – 10:10 AM
Cyril Magnin III

This session is jointly sponsored by: Human Vision and Electronic Imaging 2023, and Image Quality and System Performance XX.

Joint Conference Welcome

N/A

KEYNOTE: Bringing joy to Netflix members through perceptual encoding optimization, *Anne Aaron, Netflix, Inc. (United States)*

As Director of Encoding Technologies, Anne Aaron leads the team responsible for media processing and encoding at Netflix. Her team works on video, audio, images and timed-text, from analysis to processing, encoding, packaging and DRM. On the streaming side, they strive to deliver a compelling viewing experience for millions of Netflix members worldwide, no matter where, how and what they watch. For the Netflix studio, they build media technologies that can improve content production. In her previous role at Netflix, Aaron led the Video Algorithms team. As a team, they researched and deployed innovation in the video encoding space (per-title encoding, video quality assessment and perceptual metrics, shot-based encoding, HDR, next-generation codecs) that benefited Netflix members as well as impacted the rest of the industry. Recent recognitions include: Some recent recognitions: SMPTE 2019 Workflow Systems Medal, Forbes' 2018 America's top women in Tech, Business Insider's 2017 Most powerful female engineers in US tech in 2017.

Perceptual Video Quality 2 (T2) Joint Session

Session Chairs: Lukáš Krasula, Netflix, Inc. (United States) and Mohamed Chaker Larabi, Université de Poitiers (France)
10:50 AM – 12:30 PM
Cyril Magnin III

This session is jointly sponsored by: Human Vision and Electronic Imaging 2023, and Image Quality and System Performance XX.

10:50 N/A
Video quality of video professionals for Video Assisted Referee (VAR), *Kjell Brunnström[1,2], Anders Djupsjöbacka[1], Johsan Billingham[3], Katharina Wistel[3], Börje Andrén[1], Oskars Ozolins[1,4], and Nicolas Evans[3]; [1]RISE Research Institutes of Sweden AB (Sweden), [2]Mid Sweden University (Sweden), [3]Fédération Internationale de Football Association (FIFA) (Switzerland), and [4]KTH (Royal Institute of Technology) (Sweden)*

11:10 N/A
User perception for dynamic video resolution change using VVC, *Sachin G. Deshpande and Philip Cowan, Sharp (United States)*

11:30 IQSP-261
Proposing more ecologically-valid experiment protocol using YouTube platform, *Gabriela Wielgus, Lucjan Janowski, Kamil Koniuch, Mikolaj Leszczuk, and Rafal Figlus, AGH University of Science and Technology (Poland)*

11:50 IQSP-262
Evaluation of motion blur image quality in video frame interpolation, *Hai Dinh, Fangwen Tu, Qinyi Wang, Brett Frymire, and Bo Mu, Omnivision Technology (United States)*

12:10 IQSP-263
Subjective video quality for 4K HDR-WCG content using a browser-based approach for "at-home" testing, *Lukáš Krasula[1], Anustup Choudhury[2], Scott Daly[2], Zhi Li[1], Robin Atkins[2], Ludovic Malfait[2], and Aditya Mavlankar[1]; [1]Netflix, Inc. and [2]Dolby Laboratories, Inc. (United States)*

Tuesday 17 January PLENARY: Embedded Gain Maps for Adaptive Display of High Dynamic Range Images
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Images optimized for High Dynamic Range (HDR) displays have brighter highlights and more detailed shadows, resulting in an increased sense of realism and greater impact. However, a major issue with HDR content is the lack of consistency in appearance across different devices and viewing environments. There are several reasons, including varying capabilities of HDR displays and the different tone mapping methods implemented across software and platforms. Consequently, HDR content authors can neither control nor predict how their images will appear in other apps.

We present a flexible system that provides consistent and adaptive display of HDR images. Conceptually, the method combines both SDR and HDR renditions within a single image and interpolates between the two dynamically at display time. We compute a Gain Map that represents the difference between the two renditions. In the file, we store a Base rendition (either SDR or HDR), the Gain Map, and some associated metadata. At display time, we combine the Base image with a scaled version of the Gain Map, where the scale factor depends on the image metadata, the HDR capacity of the display, and the viewing environment.

Eric Chan, Fellow, Adobe Inc. (United States)

Eric Chan is a Fellow at Adobe, where he develops software for editing photographs. Current projects include Photoshop, Lightroom, Camera Raw, and Digital Negative (DNG). When not writing software, Chan enjoys spending time at his other keyboard, the piano. He is an enthusiastic nature photographer and often combines his photo activities with travel and hiking.

Paul M. Hubel, director of Image Quality in Software Engineering, Apple Inc. (United States)

Paul M. Hubel is director of Image Quality in Software Engineering at Apple. He has worked on computational photography and image quality of photographic systems for many years on all aspects of the imaging chain, particularly for iPhone. He trained in optical engineering at University of Rochester, Oxford University, and MIT, and has more than 50 patents on color imaging and camera technology. Hubel is active on the ISO-TC42 committee Digital Photography, where this work is under discussion, and is currently a VP on the IS&T Board. Outside work he enjoys photography, travel, cycling, coffee roasting, and plays trumpet in several bay area ensembles.

Objective Quality Assessment (T3)
Session Chair: Peter Burns, Rochester Institute of Tech. (United States)
3:30 – 5:30 PM
Cyril Magnin III

3:30 IQSP-305
Another look at SSIM image quality metric, *Yuriy Reznik, Brightcove, Inc. (United States)*

3:50 IQSP-306
What are we looking at? An investigation on the use of deep learning models for image quality assessment, *Ha Thu Nguyen and Seyed Ali Amirshahi, Norwegian University of Science and Technology (Norway)*

4:10 IQSP-307
A framework for the metrification of input image quality in deep networks, *Alexandra Psarrou and Sophie Triantaphillidou, University of Westminster (United Kingdom)*

4:30 IQSP-308
Investigating pretrained self-supervised vision transformers for reference-based quality assessment., *Kanjar De, Lulea University of Technology (Sweden)*

4:50 IQSP-309
Evaluation of image quality metrics designed for DRI tasks with automotive cameras, *Valentine Klein, Theophanis Eleftheriou, Yiqi LI, Emilie Baudin, Claudio Greco, Laurent Chanas, and Frédéric Guichard, DXOMARK (France)*

5:10 IQSP-310
Towards image-computable visual text quality metric with deep neural network, *Ling-Qi Zhang[1,2], Minjung Kim[1], James Hillis[1], and Trisha Lian[1]; [1]Meta Reality Labs and [2]University of Pennsylvania (United States)*

WEDNESDAY 18 JANUARY 2023

System Performance (W1)
Session Chair: Jonathan Phillips, Imatest, LLC (United States)
8:50 – 10:10 AM
Cyril Magnin III

8:50 IQSP-311
A tool for deriving camera spatial frequency response from natural scenes (NS-SFR), *Oliver van Zwanenberg[1], Sophie Triantaphillidou[1], and Robin B. Jenkin[1,2]; [1]University of Westminster (United Kingdom) and [2]NVIDIA Corporation (United States)*

9:10 IQSP-312
Influence of the light source on the image sensor characterization according to EMVA 1288, *Ganesh D. Kubina, Max Gäde, and Uwe Artmann, Image Engineering GmbH & Co KG (Germany)*

9:30 IQSP-313
Managing deviant data in spatial frequency response (SFR) measurement by outlier rejection, *Peter Burns[1] and Don Williams[2]; [1]Burns Digital Imaging and [2]Image Science Associates (United States)*

9:50 IQSP-314
Optimization of ISP parameters for low light conditions using a non-linear reference based approach, *Shubham Ravindra Alai[1], Radhesh Bhat[1], and Ajay Basarur[2]; [1]PathPartner Technology - Member of KPIT Group (India) and [2]presenter only (United States)*

Mobile and Camera Quality Assessment (W2)

Session Chair: Elaine Jin, Rivian Automotive, Inc. (United States)
10:50 AM – 12:30 PM
Cyril Magnin III

10:50 IQSP-315
Image quality performance of CMOS image sensor equipped with Nano Prism, *Sungho Cha, Samsung Electronics (Republic of Korea)*

11:10 IQSP-316
Noise quality estimation on portraits in realistic controlled scenarios, *Nicolas Chahine[1,2], Samuel S. Santos[3], Sofiene Lahouar[1], Ana-Stefania Calarasanu[1], Sira Ferradans[1], Benoit Pochon[1], and Frédéric Guichard[1]; [1]DXOMARK Image Labs, [2]INRIA, and [3]Parrot (France)*

11:30 IQSP-317
VCX – Version 2023 – The latest transparent and objective mobile phone test scheme, *Uwe Artmann[1] and Anthony L. Orchard[2]; [1]Image Engineering GmbH & Co KG (Germany) and [2]Intel Corporation (United States)*

11:50 N/A
VCX – A transparent and objective test scheme for webcams, *Uwe Artmann[1] and Anthony L. Orchard[2]; [1]Image Engineering GmbH & Co KG (Germany) and [2]Intel Corporation (United States)*

12:10 IQSP-319
Improvement of the flare evaluation and applications in NIR, *Elodie Souksava, Emilie Baudin, Claudio Greco, Hoang-Phi Nguyen, Laurent Chanas, and Frédéric Guichard, DxOMark Image Labs (France)*

Wednesday 18 January PLENARY: Bringing Vision Science to Electronic Imaging: The Pyramid of Visibility

Session Chair: Andreas Savakis, Rochester Institute of Technology (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Electronic imaging depends fundamentally on the capabilities and limitations of human vision. The challenge for the vision scientist is to describe these limitations to the engineer in a comprehensive, computable, and elegant formulation. Primary among these limitations are visibility of variations in light intensity over space and time, of variations in color over space and time, and of all of these patterns with position in the visual field. Lastly, we must describe how all these sensitivities vary with adapting light level. We have recently developed a structural description of human visual sensitivity that we call the Pyramid of Visibility, that accomplishes this synthesis. This talk shows how this structure accommodates all the dimensions described above, and how it can be used to solve a wide variety of problems in display engineering.

Andrew B. Watson, chief vision scientist, Apple Inc. (United States)

Andrew Watson is Chief Vision Scientist at Apple, where he leads the application of vision science to technologies, applications, and displays. His research focuses on computational models of early vision. He is the author of more than 100 scientific papers and 8 patents. He has 21,180 citations and an h-index of 63. Watson founded the Journal of Vision, and served as editor-in-chief 2001-2013 and 2018-2022. Watson has received numerous awards including the Presidential Rank Award from the President of the United States.