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PROCEEDINGS

Human Vision and Electronic Imaging 2020

Editors: **Damon Chandler,** Shizuoka University (Japan),
Mark McCourt, North Dakota State University (United States),
Jeffrey Mulligan, NASA Ames Research Center (United States)

These papers represent the program of Electronic Imaging 2020,
held 26 January — 30 January 2020, at the Hyatt Regency San Francisco Airport in Burlingame, CA.

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Human Vision and Electronic Imaging 2020

Conference overview

The conference on Human Vision and Electronic Imaging explores the role of human perception and cognition in the design, analysis, and use of electronic media systems. It brings together researchers, technologists, and artists, from all over the world, for a rich and lively exchange of ideas. We believe that understanding the human observer is fundamental to the advancement of electronic media systems, and that advances in these systems and applications drive new research into the perception and cognition of the human observer. Every year, we introduce new topics through our Special Sessions, centered on areas driving innovation at the intersection of perception and emerging media technologies. The HVEI website (https://jbmulligan.github.io/HVEI/) includes additional information and updates.

Award

Best Paper Award

Events

Daily End-of-Day Discussions
Wednesday evening HVEI Banquet and Talk

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Titles that are not listed with the proceedings files were presentation-only.

HUMAN VISION AND ELECTRONIC IMAGING 2020

Monday, January 27, 2020

Human Factors in Stereoscopic Displays — Joint Session

Session Chairs: Nicolas Holliman, University of Newcastle (United Kingdom), and Jeffrey Mulligan, NASA Ames Research Center (United States)

8:45 – 10:10 am
Grand Peninsula D
This session is jointly sponsored by: Human Vision and Electronic Imaging 2020, and Stereoscopic Displays and Applications XXXI.

8:45
Conference Welcome

8:50 HVEI-009
Stereoscopic three-dimensional optic flow distortions caused by mismatches between image acquisition and display parameters (JIST-first), *Alex Hwang and Eli Peli, Harvard Medical School (United States)*

9:10 HVEI-010
The impact of radial distortions in VR headsets on perceived surface slant (JIST-first), *Jonathan Tong, Robert Allison, and Laurie Wilcox, York University (Canada)*

9:30 SD&A-011
Visual fatigue assessment based on multi-task learning (JIST-first), *Danli Wang, Chinese Academy of Sciences (China)*

9:50 SD&A-012
Depth sensitivity investigation on multi-view glasses-free 3D display, *Di Zhang[1], Xinzhu Sang[2], and Peng Wang[2]; [1]Communication University of China and [2]Beijing University of Posts and Telecommunications (China)*

10:10 – 10:50 am Coffee Break

Predicting Camera Detection Performance — Joint Session

Session Chair: Robin Jenkin, NVIDIA Corporation (United States)

10:50 am – 12:30 pm
Regency B
This session is jointly sponsored by: Autonomous Vehicles and Machines 2020, Human Vision and Electronic Imaging 2020, and Image Quality and System Performance XVII.

10:50 AVM-038
Describing and sampling the LED flicker signal, *Robert Sumner, Imatest, LLC (United States)*

11:10 IQSP-039
Demonstration of a virtual reality driving simulation platform, *Mingming Wang and Susan Farnand, Rochester Institute of Technology (United States)*

11:30 AVM-040
Prediction and fast estimation of contrast detection probability, *Robin Jenkin, NVIDIA Corporation (United States)*

11:50 AVM-041
Object detection using an ideal observer model, *Paul Kane and Orit Skorka, ON Semiconductor (United States)*

12:10 AVM-042
Comparison of detectability index and contrast detection probability (JIST-first), *Robin Jenkin, NVIDIA Corporation (United States)*

12:30 – 2:00 pm Lunch

PLENARY: Frontiers in Computational Imaging

Session Chairs: Radka Tezaur, Intel Corporation (United States), and Jonathan Phillips, Google Inc. (United States)

2:00 – 3:10 pm
Grand Peninsula Ballroom D

Imaging the Unseen: Taking the First Picture of a Black Hole, *Katie Bouman, assistant professor, Computing and Mathematical Sciences Department, California Institute of Technology (United States)*

For abstract and speaker biography, see page 7

3:10 – 3:30 pm Coffee Break

Perceptual Image Quality — Joint Session

Session Chairs: Mohamed Chaker Larabi, Université de Poitiers (France), and Jeffrey Mulligan, NASA Ames Research Center (United States)

3:30 – 4:50 pm
Grand Peninsula A
This session is jointly sponsored by: Human Vision and Electronic Imaging 2020, and Image Quality and System Performance XVII.

3:30 IQSP-066
Perceptual quality assessment of enhanced images using a crowdsourcing framework, *Muhammad Irshad[1], Alessandro Silva[1,2], Sana Alamgeer[1], and Mylène Farias[1]; [1]University of Brasilia and [2]IFG (Brazil)*

3:50 IQSP-067
Perceptual image quality assessment for various viewing conditions and display systems, *Andrei Chubarau[1], Tara Akhavan[2], Hyunjin Yoo[2], Rafal Mantiuk[3], and James Clark[1]; [1]McGill University (Canada), [2]IRYStec Software Inc. (Canada), and [3]University of Cambridge (United Kingdom)*

4:10 HVEI-068
Improved temporal pooling for perceptual video quality assessment using VMAF, *Sophia Batsi and Lisimachos Kondi, University of Ioannina (Greece)*

4:30 HVEI-069
Quality assessment protocols for omnidirectional video quality evaluation, *Ashutosh Singla, Stephan Fremerey, Werner Robitza, and Alexander Raake, Technische Universität Ilmenau (Germany)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 28, 2020

7:30 – 8:45 am Women in Electronic Imaging Breakfast; pre-registration required

Video Quality Experts Group I — Joint Session

Session Chairs: Kjell Brunnström, RISE Acreo AB (Sweden), and Jeffrey Mulligan, NASA Ames Research Center (United States)

8:50 – 10:10 am
Grand Peninsula A

This session is jointly sponsored by: Human Vision and Electronic Imaging 2020, and Image Quality and System Performance XVII.

8:50 HVEI-090
The Video Quality Experts Group - Current activities and research, *Kjell Brunnström[1,2] and Margaret Pinson[3]; [1]RISE Acreo AB (Sweden), [2]Mid Sweden University (Sweden), and [3]National Telecommunications and Information Administration, Institute for Telecommunications Sciences (United States)*

9:10 HVEI-091
Quality of experience assessment of 360-degree video, *Anouk van Kasteren[1,2], Kjell Brunnström[1,3], John Hedlund[1], and Chris Snijders[2]; [1]RISE Research Institutes of Sweden AB (Sweden), [2]University of Technology Eindhoven (the Netherlands), and [3]Mid Sweden University (Sweden)*

9:30 HVEI-092
Open software framework for collaborative development of no reference image and video quality metrics, *Margaret Pinson[1], Philip Corriveau[2], Mikolaj Leszczuk[3], and Michael Colligan[4]; [1]US Department of Commerce (United States), [2]Intel Corporation (United States), [3]AGH University of Science and Technology (Poland), and [4]Spirent Communications (United States)*

9:50 HVEI-093
Investigating prediction accuracy of full reference objective video quality measures through the ITS4S dataset, *Antonio Servetti, Enrico Masala, and Lohic Fotio Tiotsop, Politecnico di Torino (Italy)*

10:00 am – 7:30 pm Industry Exhibition - Tuesday

10:10 – 10:50 am Coffee Break

Video Quality Experts Group II — Joint Session

Session Chair: Kjell Brunnström, RISE Acreo AB (Sweden)

10:50 am – 12:30 pm
Grand Peninsula A

This session is jointly sponsored by: Human Vision and Electronic Imaging 2020, and Image Quality and System Performance XVII.

10:50 HVEI-128
Quality evaluation of 3D objects in mixed reality for different lighting conditions, *Jesús Gutiérrez, Toinon Vigier, and Patrick Le Callet, Université de Nantes (France)*

11:10 HVEI-129
Defining gaze tracking metrics by observing a growing divide between 2D and 3D gaze tracking, *William Blakey[1,2], Navid Hajimirza[1], and Naeem Ramzan[2]; [1]Lumen Research Limited and [2]University of the West of Scotland (United Kingdom)*

11:30 HVEI-130
Predicting single observer's votes from objective measures using neural networks, *Lohic Fotio Tiotsop[1], Tomas Mizdos[2], Miroslav Uhrina[2], Peter Pocta[2], Marcus Barkowsky[3], and Enrico Masala[1]; [1]Politecnico di Torino (Italy), [2]Zilina University (Slovakia), and [3]Deggendorf Institute of Technology (DIT) (Germany)*

11:50 HVEI-131
A simple model for subject behavior in subjective experiments, *Zhi Li[1], Ioannis Katsavounidis[2], Christos Bampis[1], and Lucjan Janowski[3]; [1]Netflix, Inc. (United States), [2]Facebook, Inc. (United States), and [3]AGH University of Science and Technology (Poland)*

12:10 HVEI-132
Characterization of user generated content for perceptually-optimized video compression: Challenges, observations, and perspectives, *Suiyi Ling[1,2], Yoann Baveye[1,2], Patrick Le Callet[2], Jim Skinner[3], and Ioannis Katsavounidis[3]; [1]CAPACITÉS (France), [2]Université de Nantes (France), and [3]Facebook, Inc. (United States)*

12:30 – 2:00 pm Lunch

PLENARY: Automotive Imaging

Session Chairs: Radka Tezaur, Intel Corporation (United States), and Jonathan Phillips, Google Inc. (United States)

2:00 – 3:10 pm
Grand Peninsula Ballroom D

Imaging in the Autonomous Vehicle Revolution, *Gary Hicok, senior vice president, hardware development, NVIDIA Corporation (United States)*

For abstract and speaker biography, see page 7

3:10 – 3:30 pm Coffee Break

Image Quality Metrics — Joint Session

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

3:30 – 5:10 pm
Grand Peninsula A

This session is jointly sponsored by: Human Vision and Electronic Imaging 2020, and Image Quality and System Performance XVII.

3:30 IQSP-166
DXOMARK objective video quality measurements, *Emilie Baudin, Laurent Chanas, and Frédéric Guichard, DXOMARK (France)*

3:50 IQSP-167
Analyzing the performance of autoencoder-based objective quality metrics on audio-visual content, *Helard Becerra[1], Mylène Farias[1], and Andrew Hines[2]; [1]University of Brasilia (Brazil) and [2]University College Dublin (Ireland)*

4:10 IQSP-168
No reference video quality assessment with authentic distortions using 3-D deep convolutional neural network, *Roger Nieto[1], Hernan Dario Benitez Restrepo[1], Roger Figueroa Quintero[1], and Alan Bovik[2]; [1]Pontificia University Javeriana, Cali (Colombia) and [2]The University of Texas at Austin (United States)*

4:30 IQSP-169
Quality aware feature selection for video object tracking, *Roger Nieto[1], Carlos Quiroga[2], Jose Ruiz-Munoz[3], and Hernan Benitez-Restrepo[1]; [1]Pontificia University Javeriana, Cali (Colombia), [2]Universidad del Valle (Colombia), and [3]University of Florida (United States)*

4:50 IQSP-170
Studies on the effects of megapixel sensor resolution on displayed image quality and relevant metrics, *Sophie Triantaphillidou[1], Jan Smejkal[1], Edward Fry[1], and Chuang Hsin Hung[2]; [1]University of Westminster (United Kingdom) and [2]Huawei (China)*

DISCUSSION: HVEI Tuesday Wrap-up Q&A

Session Chairs: Damon Chandler, Shizuoka University (Japan); Mark McCourt, North Dakota State University (United States); and Jeffrey Mulligan, NASA Ames Research Center (United States)

5:10 – 5:40 pm
Grand Peninsula A

5:30 – 7:30 pm Symposium Demonstration Session

Wednesday, January 29, 2020

Image Processing and Perception

Session Chair: Damon Chandler, Shizuoka University (Japan)

9:10 – 10:10 am
Grand Peninsula A

9:10 HVEI-208
Neural edge integration model accounts for the staircase-Gelb and scrambled-Gelb effects in lightness perception, *Michael Rudd, University of Washington (United States)*

9:30 HVEI-209
Influence of texture structure on the perception of color composition (JPI-first), *Jing Wang[1], Jana Zujovic[2], June Choi[3], Basabdutta Chakraborty[4], Rene van Egmond[5], Huib de Ridder[5], and Thrasyvoulos Pappas[1]; [1]Northwestern University (United States), [2]Google, Inc. (United States), [3]Accenture (United States), [4]Amway (United States), and [5]Delft University of Technology (the Netherlands)*

9:50 HVEI-210
Evaluation of tablet-based methods for assessment of contrast sensitivity, *Jeffrey Mulligan, NASA Ames Research Center (United States)*

10:00 am – 3:30 pm Industry Exhibition - Wednesday

10:10 – 10:50 am Coffee Break

Psychophysics and LED Flicker Artifacts — Joint Session

Session Chair: Jeffrey Mulligan, NASA Ames Research Center (United States)

10:50 – 11:30 am
Regency B
This session is jointly sponsored by: Autonomous Vehicles and Machines 2020, and Human Vision and Electronic Imaging 2020.

10:50 HVEI-233
Predicting visible flicker in temporally changing images, *Gyorgy Denes and Rafal Mantiuk, University of Cambridge (United Kingdom)*

11:10 HVEI-234
Psychophysics study on LED flicker artefacts for automotive digital mirror replacement systems, *Nicolai Behmann and Holger Blume, Leibniz University Hannover (Germany)*

12:30 – 2:00 pm Lunch

PLENARY: VR/AR Future Technology

Session Chairs: Radka Tezaur, Intel Corporation (United States), and Jonathan Phillips, Google Inc. (United States)

2:00 – 3:10 pm
Grand Peninsula Ballroom D

Quality Screen Time: Leveraging Computational Displays for Spatial Computing, *Douglas Lanman, director, Display Systems Research, Facebook Reality Labs (United States)*

For abstract and speaker biography, see page 7

3:10 – 3:30 pm Coffee Break

Faces in Art / Human Feature Use

Session Chair: Mark McCourt, North Dakota State University (United States)

3:30 – 4:10 pm
Grand Peninsula A

3:30 HVEI-267
Conventions and temporal differences in painted faces: A study of posture and color distribution, *Mitchell van Zuijlen, Sylvia Pont, and Maarten Wijntjes, Delft University of Technology (the Netherlands)*

3:50 HVEI-268
Neural and neuromimetic perception: A comparative study of gender classification from human gait (JPI-first), *Viswadeep Sarangi[1], Adar Pelah[1], William Hahn[2], and Elan Barenholtz[2]; [1]University of York (United Kingdom) and [2]Florida Atlantic University (United States)*

DISCUSSION: HVEI Wednesday Wrap-up Q&A

Session Chairs: Damon Chandler, Shizuoka University (Japan); Mark McCourt, North Dakota State University (United States); and Jeffrey Mulligan, NASA Ames Research Center (United States)

4:10 – 5:00 pm
Grand Peninsula A

5:30 – 7:00 pm EI 2020 Symposium Interactive Posters Session

5:30 – 7:00 pm Meet the Future: A Showcase of Student and Young Professionals Research

2020 Friends of HVEI Banquet

7:00 – 10:00 pm
Offsite Restaurant
This annual event brings the HVEI community together for great food and convivial conversation. The presenter is Prof. Bruno Olshausen (UC Berkeley), speaking on "Perception as inference." See the Keynotes section for details. Registration required, online or at the registration desk. Location will be provided with registration.

Thursday, January 30, 2020

KEYNOTE: Multisensory and Crossmodal Interactions

Session Chair: Lora Likova, Smith-Kettlewell Eye Research Institute (United States)

9:10 – 10:10 am
Grand Peninsula A

HVEI-354

Multisensory interactions and plasticity – Shooting hidden assumptions, revealing postdictive aspects, *Shinsuke Shimojo, professor and principle investigator, California Institute of Technology (United States)*

Biographies and/or abstracts for all keynotes are found on pages 9–14

10:10 – 10:50 am Coffee Break

Multisensory and Crossmodal Interactions I

Session Chair: Mark McCourt, North Dakota State University (United States)

10:50 am – 12:30 pm
Grand Peninsula A

10:50 HVEI-365
Multisensory contributions to learning face-name associations, *Carolyn Murray, Sarah May Tarlow, and Ladan Shams, University of California, Los Angeles (United States)*

11:10 HVEI-366
Differences in the major fiber-tracts of people with congenital and acquired blindness, *Katherine E.M. Tregillus and Lora T. Likova, Smith-Kettlewell Eye Research Institute (United States)*

11:30 HVEI-367
Changes in auditory-visual perception induced by partial vision loss: Use of novel multisensory illusions, *Noelle Stiles[1,2], Armand Tanguay[2,3], Ishani Ganguly[2], Carmel Levitan[4], and Shinsuke Shimojo[2]; [1]Keck School of Medicine, University of Southern California, [2]California Institute of Technology, [3]University of Southern California, and [4]Occidental College (United States)*

11:50 HVEI-368
Multisensory temporal processing in early deaf individuals, *Fang Jiang, University of Nevada, Reno (United States)*

12:10 HVEI-369
Inter- and intra-individual variability in multisensory integration in autism spectrum development: A behavioral and electrophysiological study, *Clifford Saron[1], Yukari Takarae[2], Iman Mohammadrezazadeh[3], and Susan Rivera[1]; [1]University of California, Davis, [2]University of California, San Diego, and [3]HRL Laboratories (United States)*

12:30 – 2:00 pm Lunch

Multisensory and Crossmodal Interactions II

Session Chair: Lora Likova, Smith-Kettlewell Eye Research Institute (United States)

2:00 – 3:00 pm
Grand Peninsula A

2:00 HVEI-383
Auditory capture of visual motion: Effect of audio-visual stimulus onset asynchrony, *Mark McCourt, Emily Boehm, and Ganesh Padmanabhan, North Dakota State University (United States)*

2:20 **WITHDRAWN** HVEI-384
Auditory and audiovisual processing in visual cortex, *Jessica Green, University of South Carolina (United States)*

2:40 HVEI-385
Perception of a stable visual environment during head motion depends on motor signals, *Paul MacNeilage, University of Nevada, Reno (United States)*

3:00 – 3:30 pm Coffee Break

Multisensory and Crossmodal Interactions III

Session Chair: Mark McCourt, North Dakota State University (United States)

3:30 – 5:00 pm
Grand Peninsula A

3:30 HVEI-393
Multisensory aesthetics: Visual, tactile and auditory preferences for fractal-scaling characteristics, *Branka Spehar, University of New South Wales (Australia)*

3:50 HVEI-394
Introducing Vis+Tact(TM) iPhone app, *Jeannette Mahoney, Albert Einstein College of Medicine (United States)*

4:10 HVEI-395
An accelerated Minkowski summation rule for multisensory cue combination, *Christopher Tyler, Smith-Kettlewell Eye Research Institute (United States)*

4:30
Multisensory Discussion

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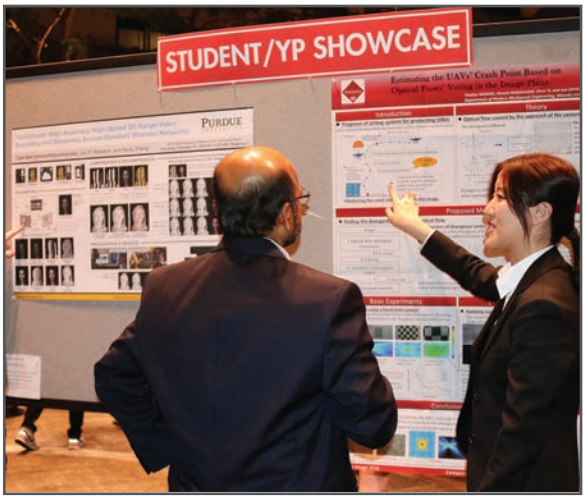

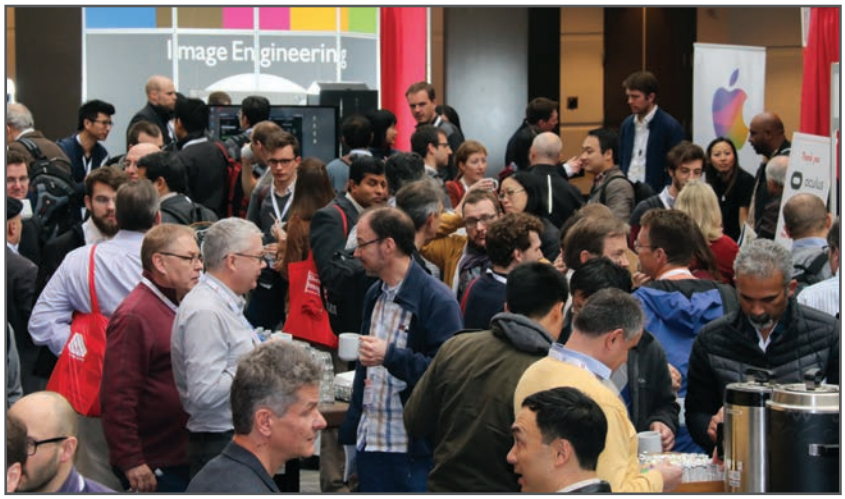

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