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PROCEEDINGS

IS&T International Symposium on

Electronic Imaging

SCIENCE AND TECHNOLOGY

26 January 2020 — 30 January 2020 • Burlingame, CA, USA

Autonomous Vehicles and Machines 2020

Editors: **Patrick Denny,** Valeo (Ireland),
Robin Jenkin, NVIDIA Corporation (United States), and
Peter van Beek, Intel Corporation (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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Autonomous Vehicles and Machines 2020

Conference overview

Advancements in sensing, computing, imaging processing, and computer vision technologies are enabling unprecedented growth and interest in autonomous vehicles and intelligent machines, from self-driving cars to unmanned drones and personal service robots. These new capabilities have the potential to fundamentally change the way people live, work, commute, and connect with each other and will undoubtedly provoke entirely new applications and commercial opportunities for generations to come.

Successfully launched in 2017, Autonomous Vehicles and Machines (AVM) considers a broad range of topics as it relates to equipping vehicles and machines with the capacity to perceive dynamic environments, inform human participants, demonstrate situational awareness, and make unsupervised decisions on self-navigating. The conference seeks high-quality papers featuring novel research in areas intersecting sensing, imaging, vision, and perception with applications including, but not limited to, autonomous cars, ADAS (advanced driver assistance system), drones, robots, and industrial automation. AVM welcomes both academic researchers and industrial experts to join the discussion. In addition to the main technical program, AVM will include interactive and open forum sessions between AVM speakers, committee members, and conference participants.

Awards

Best Paper Award and Best Student Paper Award

Paper authors listed as of 1 January 2020;
refer to manuscript for final authors.
Titles that are not listed with the proceedings
files were presentation-only.

Conference Sponsor

AutoSens

AUTONOMOUS VEHICLES AND MACHINES 2020

Monday, January 27, 2020

KEYNOTE: Automotive Camera Image Quality — Joint Session

Session Chair: Luke Cui, Amazon (United States)

8:45 – 9:30 am
Regency B
This session is jointly sponsored by: Autonomous Vehicles and Machines 2020, and Image Quality and System Performance XVII.

8:45
Conference Welcome

8:50 AVM-001
LED flicker measurement: Challenges, considerations, and updates from IEEE P2020 working group, *Brian Deegan, senior expert, Valeo Vision Systems (Ireland)*

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

Automotive Camera Image Quality — Joint Session

Session Chair: Luke Cui, Amazon (United States)

9:30 – 10:10 am
Regency B
This session is jointly sponsored by: Autonomous Vehicles and Machines 2020, and Image Quality and System Performance XVII.

9:30 IQSP-018
A new dimension in geometric camera calibration, *Dietmar Wueller, Image Engineering GmbH & Co. KG (Germany)*

9:50 AVM-019
Automotive image quality concepts for the next SAE levels: Color separation probability and contrast detection probability, *Marc Geese, Continental AG (Germany)*

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
Fast prediction 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

KEYNOTE: Visibility

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

3:30 – 4:10 pm
Regency B

AVM-057
The automated drive west: Results, *Sara Sargent, engineering project manager, VSI Labs (United States)*

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

Visibility

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

4:10 – 5:10 pm
Regency B

4:10 AVM-079
VisibilityNet: Camera visibility detection and image restoration for autonomous driving, *Hazem Rashed, Senthil Yogamani, and Michal Uricar, Valeo Group (Egypt)*

4:30 AVM-080
Sun-glare detection using late fusion of CNN and image processing operators, *Lucie Yahiaoui and Senthil Yogamani, Valeo Vision Systems (Ireland)*

4:50 AVM-081
Single image haze removal using multiple scattering model for road scenes, *Minsub Kim, Soonyoung Hong, and Moon Gi Kang, Yonsei University (Republic of Korea)*

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

KEYNOTE: Human Interaction

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

8:50 – 9:30 am
Regency B

AVM-088
Regaining sight of humanity on the roadway towards automation, *Mónica López-González, La Petite Noiseuse Productions (United States)*

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

Human Interaction

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

9:30 – 10:30 am
Regency B

9:30 AVM-109
VRUNet: Multitask learning model for intent prediction of vulnerable road users, *Adithya Pravarun Reddy Ranga[1], Filippo Giruzzi[2], Jagdish Bhanushali[1], Emilie Wirbel[3], Patrick Pérez[4], Tuan-Hung VU[4], and Xavier Perrotton[3]; [1]Valeo NA Inc. (United States), [2]MINES Paristech (France), [3]Valeo France (France), and [4]Valeo.ai (France)*

9:50 AVM-108
Multiple pedestrian tracking using Siamese random forests and shallow convolutional neural networks, *Jimi Lee, Jaeyeal Nam, and ByoungChul Ko, Keimyung University (Republic of Korea)*

10:10 AVM-110
End-to-end multitask learning for driver gaze and head pose estimation, *Marwa El Shawarby[1], Mahmoud Ewaisha[1], Hazem Abbas[1], and Ibrahim Sobh[2]; [1]Ain Shams University and [2]Valeo Group (Egypt)*

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

10:10 – 10:50 am Coffee Break

KEYNOTE: Quality Metrics

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

10:50 – 11:30 am
Regency B

AVM-124
Automated optimization of ISP hyperparameters to improve computer vision accuracy, *Doug Taylor, Avinash Sharma, Karl St. Arnaud, and Dave Tokic, Algolux (Canada)*

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

Quality Metrics

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

11:30 am – 12:30 pm
Regency B

11:30 AVM-148
Using the dead leaves pattern for more than spatial frequency response measurements, *Uwe Artmann, Image Engineering GmbH & Co. KG (Germany)*

11:50 AVM-149
Simulating tests to test simulation, *Patrick Müller, Matthias Lehmann, and Alexander Braun, Düsseldorf University of Applied Sciences (Germany)*

12:10 AVM-150
Validation methods for geometric camera calibration, *Paul Romanczyk, Imatest, LLC (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

PANEL: Sensors Technologies for Autonomous Vehicles — Joint Session

Panel Moderator: David Cardinal, Cardinal Photo & Extremetech.com (United States)
Panelists: Sanjai Kohli, Visible Sensors, Inc. (United States); Nikhil Naikal, Velodyne Lidar (United States); Greg Stanley, NXP Semiconductors (United States); Alberto Stochino, Perceptive Machines (United States); Nicolas Touchard, DXOMARK (France); and Mike Walters, FLIR Systems (United States)

3:30 – 5:30 pm
Regency A

This session is jointly sponsored by: Autonomous Vehicles and Machines 2020, and Imaging Sensors and Systems 2020.

Imaging sensors are at the heart of any self-driving car project. However, selecting the right technologies isn't simple. Competitive products span a gamut of capabilities including traditional visible-light cameras, thermal cameras, lidar, and radar. This session includes experts in all of these areas, and in emerging technologies, who will help attendees understand the strengths, weaknesses, and future directions of each. Presentations are followed by a panel discussion. Introduction, David Cardinal, consultant and technology journalist (United States); LiDAR for Self-driving Cars, Nikhil Naikal, VP of software engineering, Velodyne Lidar (United States); Challenges in Designing Cameras for Self-driving Cars, Nicolas Touchard, VP of marketing, DXOMARK (France); Using Thermal Imaging to Help Cars See Better, Mike Walters, VP of product management for thermal cameras, FLIR Systems, Inc. (United States); Radar's Role, Greg Stanley, field applications engineer, NXP Semiconductors (the Netherlands); Tales from the Automotive Sensor Trenches, Sanjai Kohli, CEO, Visible Sensors, Inc. (United States); Auto Sensors for the Future, Alberto Stochino, founder and CEO, Perceptive (United States)

Biographies and/or abstracts are found on pages 15–21

5:30 – 7:30 pm Symposium Demonstration Session

Wednesday, January 29, 2020

Data Collection and Generation

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

8:50 – 10:10 am
Regency B

8:50 AVM-200
A tool for semi-automatic ground truth annotation of traffic videos, *Florian Groh, Margrit Gelautz, and Dominik Schörkhuber, TU Wien (Austria)*

9:10 WITHDRAWN AVM-201
A low-cost approach to data collection and processing for autonomous vehicles with a realistic virtual environment, *Victor Fernandes[1], Verônica Silva[2], and Thais Rêgo[1]; [1]Federal University of Paraiba and [2]Ufersa (Brazil)*

9:30 AVM-202
Metrology impact of advanced driver assistance systems, *Paola Iacomussi, INRIM (Italy)*

9:50 AVM-203
A study on training data selection for object detection in nighttime traffic scenes, *Astrid Unger[1,2], Margrit Gelautz[1], Florian Seitner[2], and Michael Hödlmoser[2]; [1]TU Wien and [2]Emotion3D (Austria)*

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)*

Multi-Sensor

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

11:30 am – 12:30 pm
Regency B

11:30 AVM-255
Multi-sensor fusion in dynamic environments using evidential grid mapping, *Dilshan Godaliyadda, Vijay Pothukuchi, and JuneChul Roh, Texas Instruments (United States)*

11:50 AVM-257
LiDAR-camera fusion for 3D object detection, *Darshan Ramesh Bhanushali, Robert Relyea, Karan Manghi, Abhishek Vashist, Clark Hochgraf, Amlan Ganguly, Michael Kuhl, Andres Kwasinski, and Ray Ptucha, Rochester Institute of Technology (United States)*

12:10 AVM-258
Active stereo vision for precise autonomous vehicle control, *Song Zhang and Michael Feller, Purdue University (United States)*

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

KEYNOTE: Image Processing

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

3:30 – 4:10 pm
Regency B

AVM-262

Deep image processing, *Vladlen Koltun, chief scientist for Intelligent Systems, Intel Labs (United States)*

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

Image Processing

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

4:10 – 5:30 pm
Regency B

4:10 AVM-296
End-to-end deep path planning and automatic emergency braking camera cocoon-based solution, *Mohammed Abdou and Eslam Bakr, Valeo Group (Egypt)*

4:30 AVM-297
Federated semantic mapping and localization for autonomous driving, *Ravi Kiran[1] and Senthil Yogamani[2]; [1]Navya (France) and [2]Valeo Vision Systems (Ireland)*

4:50 AVM-298
Progress on the AUTOSAR adaptive platform for intelligent vehicles, *Keith Derrick, AUTOSAR (Germany)*

5:10 AVM-299
Object tracking continuity through track and trace method, *Haney Williams and Steven Simske, Colorado State University (United States)*

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

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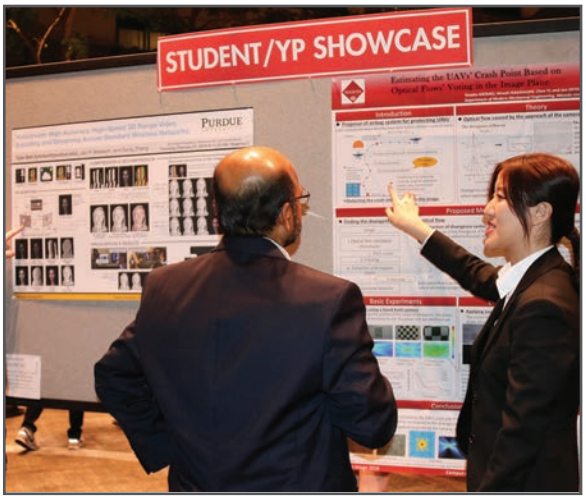

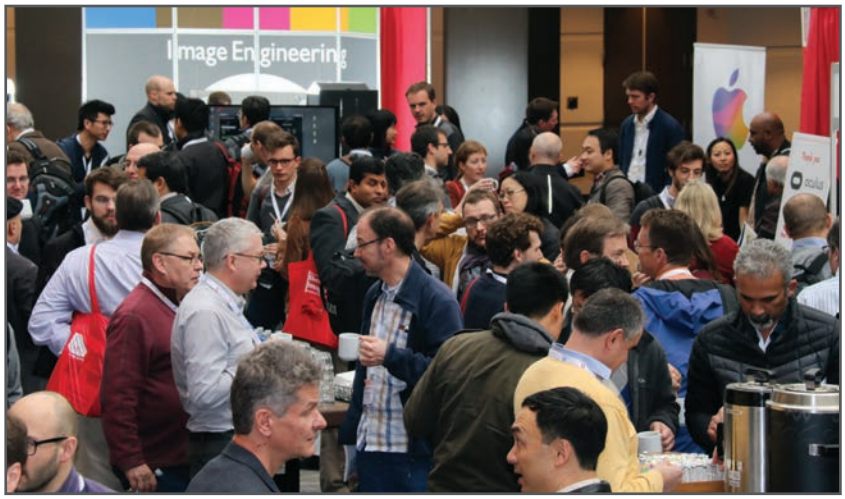

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