IS&T International Symposium on

Electronic Imaging

SCIENCE AND TECHNOLOGY

13 January 2019 – 17 January 2019 • Burlingame, CA, USA

PROCEEDINGS

3D Image Measurement and Data Processing 2019

Editors: **William Puech,** Lab. d'Informatique de Robotique et de Microelectronique de Montpellier (France),
Robert Sitnik, Warsaw Univ. of Technology (Poland)

These papers represent the program of Electronic Imaging 2019,
held 13 January – 17 January 2019, at the Hyatt Regency San Francisco Airport in Burlingame, CA.

Copyright 2019

3D Measurement and Data Processing 2019

Conference overview

Scientific and technological advances during the last decade in the fields of image acquisition, processing, telecommunications, and computer graphics have contributed to the emergence of new multimedia, especially 3D digital data. Nowadays, the acquisition, processing, transmission, and visualization of 3D objects are a part of possible and realistic functionalities over the internet. Confirmed 3D processing techniques exist and a large scientific community works hard on open problems and new challenges, including 3D data processing, transmission, fast access to huge 3D databases, or content security management.

The emergence of 3D media is directly related to the emergence of 3D acquisition technologies. Indeed, recent advances in 3D scanner acquisition and 3D graphics rendering technologies boost the creation of 3D model archives for several application domains. These include archaeology, cultural heritage, computer assisted design (CAD), medicine, face recognition, video games, and bioinformatics. New devices such as time-of-flight cameras open challenging new perspectives on 3D scene analysis and reconstruction.

Three-dimensional objects are more complex to handle than other multimedia data, such as audio signals, images, or videos. Indeed, only a unique and simple 2D grid representation is associated to a 2D image. All the 2D acquisition devices generate this same representation (digital cameras, scanners, 2D medical systems). Unfortunately (for the users), but fortunately (for scientists), there exist different 3D representations for a 3D object. For example, an object can be represented on a 3D grid (digital image) or in 3D Euclidian space. In the latter, the object can be expressed by a single equation (like algebraic implicit surfaces), by a set of facets representing its boundary surface, or by a set of mathematical surfaces. One can easily imagine the numerous open problems related to these different representations and their processing, a new challenge for the image processing community.

Conference Chairs: **William Puech,** Lab. d'Informatique de Robotique et de Microelectronique de Montpellier (France), and **Robert Sitnik,** Warsaw University of Technology (Poland)

Program Committee: **Atilla M. Baskurt,** Université de Lyon (France); **Hugues Benoit-Cattin,** Institut National des Sciences Appliquées de Lyon (France); **Silvia Biasotti,** Consiglio Nazionale delle Ricerche (Italy); **Adrian G. Bors,** The University of York (United Kingdom); **Saida Bouakaz,** University Claude Bernard Lyon 1 (France); **Mohamed Daoudi,** Télécom Lille 1 (France); **Florent Dupont,** University Claude Bernard Lyon 1 (France); **Gilles Gesquière,** Lab. des Sciences de l'Information et des Systèmes (France); **Afzal Godil,** National Institute of Standards and Technology (United States); **Serge Miguet,** University Lumière Lyon 2 (France); **Eric Paquet,** National Research Council Canada (Canada); **Frédéric Payan,** University of Nice Sophia Antipolis - I3S Laboratory, CNRS (France); **Frédéric Truchetet,** Université de Bourgogne (France); and **Stefano Tubaro,** Politecnico di Milano (Italy)

3DMP

3D MEASUREMENT AND DATA PROCESSING 2019

Wednesday, January 16, 2019

3D/4D Scanning and Applications

Session Chair: Robert Sitnik, Warsaw University of Technology (Poland)

8:50 – 10:30 am
Regency C

8:50   3DMP-001
High-speed multiview 3D structured light imaging technique, *Chufan Jiang and Song Zhang, Purdue University (United States)*

9:10   3DMP-002
4D scanning system for measurement of human body in motion, *Robert Sitnik, Pawel Liberadzki, and Jakub Michonski, Warsaw University of Technology (Poland)*

9:30   3DMP-003
3D microscopic imaging using Structure-from-Motion, *Lukas Traxler and Svorad Štolc, AIT Austrian Institute of Technology GmbH (Austria)*

9:50   3DMP-004
Depth-map estimation using combination of global deep network and local deep random forest, *SangJun Kim, Sangwon Kim, Mira Jeong, Deokwoo Lee, and ByoungChul Ko, Keimyung University (Republic of Korea)*

10:10   3DMP-005
Metrology on field-of-light display: Volumetric display, *Abhishek Bichal and Thomas Burnett, FoVI3D (United States)*

10:00 am – 3:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

3D Data Processing and Visualization

Session Chair: Robert Sitnik, Warsaw University of Technology (Poland)

10:50 am – 12:10 pm
Regency C

10:50   3DMP-006
Real-time 3D volumetric reconstruction of human body from single view RGB-D capture device, *Rafael Diniz and Mylène Farias, University of Brasilia (Brazil)*

11:10   3DMP-007
Holo reality: Real-time low-bandwidth 3D range video communications on consumer mobile devices with application to augmented reality, *Tyler Bell[1] and Song Zhang[2]; [1]University of Iowa and [2]Purdue University (United States)*

11:30   3DMP-008
Modified M-estimation for fast global registration of 3D point clouds, *Faisal Azhar, Stephen Pollard, and Guy Adams, HP Inc. (United Kingdom)*

11:50   3DMP-010
Crotch detection on 3D optical scans of human subjects, *Sima Sobhiyeh[1], Friedrich Dunkel[2], Marcelline Dechenaud[2], Samantha Kennedy[1], John Shepherd[3], Steven Heymsfield[1], and Peter Wolenski[2]; [1]Pennington Biomedical Research Center, [2]Louisiana State University, and [3]University of California, San Francisco (United States)*

12:30 – 2:00 pm Lunch

Wednesday Plenary

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

Light Fields and Light Stages for Photoreal Movies, Games, and Virtual Reality, *Paul Debevec, senior scientist, Google (United States)*

Paul Debevec will discuss the technology and production processes behind "Welcome to Light Fields", the first downloadable virtual reality experience based on light field capture techniques which allow the visual appearance of an explorable volume of space to be recorded and reprojected photorealistically in VR enabling full 6DOF head movement. The lightfields technique differs from conventional approaches such as 3D modelling and photogrammetry. Debevec will discuss the theory and application of the technique. Debevec will also discuss the Light Stage computational illumination and facial scanning systems which use geodesic spheres of inward-pointing LED lights as have been used to create digital actor effects in movies such as Avatar, Benjamin Button, and Gravity, and have recently been used to create photoreal digital actors based on real people in movies such as Furious 7, Blade Runner: 2049, and Ready Player One. The lighting reproduction process of light stages allows omnidirectional lighting environments captured from the real world to be accurately reproduced in a studio, and has recently be extended with multispectral capabilities to enable LED lighting to accurately mimic the color rendition properties of daylight, incandescent, and mixed lighting environments. They have also recently used their full-body light stage in conjunction with natural language processing and automultiscopic video projection to record and project interactive conversations with survivors of the World War II Holocaust.

Paul Debevec is a senior scientist at Google VR, a member of Google VR's Daydream team, and adjunct research professor of computer science in the Viterbi School of Engineering at the University of Southern California, working within the Vision and Graphics Laboratory at the USC Institute for Creative Technologies. Debevec's computer graphics research has been recognized with ACM SIGGRAPH's first Significant New Researcher Award (2001) for "Creative and Innovative Work in the Field of Image-Based Modeling and Rendering", a Scientific and Engineering Academy Award (2010) for "the design and engineering of the Light Stage capture devices and the image-based facial rendering system developed for character relighting in motion pictures" with Tim Hawkins, John Monos, and Mark Sagar, and the SMPTE Progress Medal (2017) in recognition of his achievements and ongoing work in pioneering techniques for illuminating computer-generated objects based on measurement of real-world illumination and their effective commercial application in numerous Hollywood films. In 2014, he was profiled in The New Yorker *magazine's "Pixel Perfect: The Scientist Behind the Digital Cloning of Actors" article by Margaret Talbot.*

3:00 – 3:30 pm Coffee Break

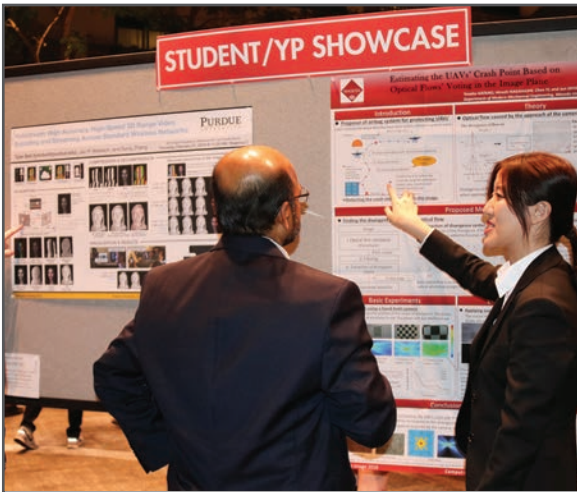5:30 – 7:00 pm Symposium Interactive Papers (Poster) Session

3DMP