IS&T International Symposium on

Electronic Imaging

SCIENCE AND TECHNOLOGY

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PROCEEDINGS

The Engineering Reality of Virtual Reality 2018

Editors: **Margaret Dolinsky,** Indiana Univ. (United States),
Ian E. McDowall, Fakespace Labs, Inc. (United States)

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The Engineering Reality of Virtual Reality 2018

Symposium Chairs
Joyce Farrell, Stanford University (United States)
Andrew Woods, Curtin University (Australia)

Symposium Short Course Chairs
Susan Farnand, Rochester Institute of Technology (United States)
Mohamed-Chaker Larabi, University of Poitiers (France)
Jonathan B. Phillips, Google, Inc. (United States)

At-large Conference Chair Representative
Adnan Alattar, Digimarc (United States)

Past Symposium Chair
Nitin Sampat, Rochester Institute of Technology (United States)

Conference Chairs
Margaret Dolinsky, Indiana Univ. (United States)
Ian E. McDowall, Fakespace Labs, Inc. (United States)

Introduction

Virtual and augmented reality systems are evolving. In addition to research, the trend toward content building continues and practitioners find that technologies and disciplines must be tailored and integrated for specific visualization and interactive applications. This conference serves as a forum where advances and practical advice toward both creative activity and scientific investigation are presented and discussed. Research results are presented and applications are demonstrated.

This year ERVR expanded into joint sessions on Tuesday and Wednesday. On Tuesday ERVR co-hosted the Bioinformatics sessions with Stereoscopic Displays and Applications XXIX. On Wednesday ERVR co-hosted the Immersive Imaging sessions with two other conferences, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX. The Wednesday program also included a reprise of the Visualization Facilities joint session with Stereoscopic Displays and Applications XXIX. On Thursday the core ERVR conference sessions kicked off with a keynote by Dr. Jason Leigh, Director at the Laboratory for Advanced Visualization and Applications (LAVA), University of Hawai'i at Mānoa; and Director Emeritus-Electronic Visualization Lab, University of Illinois at Chicago. Leigh teaches classes in Software Design and he has been teaching Video Game Design for over 10 years. In 2010 his video game design class enabled the University of Illinois at Chicago to be ranked among the top 50 video game programs in US and Canada.

— Margaret Dolinsky, Indiana Univ.
Ian E. McDowall, Fakespace Labs, Inc.

The Engineering Reality of Virtual Reality 2018

Tuesday, January 30, 2018

7:15 – 8:45 am   Women in Electronic Imaging Breakfast

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 1
JOINT SESSION

Session Chair: Björn Sommer, University of Konstanz (Germany)

8:50 – 10:10 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

8:50   SD&A-189

Mesoscopic rigid body modeling of the ExtraCellular Matrix's self assembly, *Hua Wong, Nicolas Belloy, and Manuel Dauchez, University of Reims Champagne-Ardenne (France)*

9:10   SD&A-190

Semantics for an integrative and immersive pipeline combining visualisation and analysis of molecular data, *Mikael Trellet[1], Nicolas Ferey[1], Patrick Bourdot[1], and Marc Baaden[2]; [1]LIMSI and [2]IBPC (France)*

9:30   SD&A-191

3D-stereoscopic modeling and visualization of a Chlamydomonas reinhardtii cell, *Niklas Biere[1], Mehmood Ghaffar[1], Daniel Jäger[1], Anja Doebbe[1], Nils Rothe[1], Karsten Klein[2,3], Ralf Hofestädt[1], Falk Schreiber[2,3], Olaf Kruse[1], and Björn Sommer[2,3]; [1]Bielefeld University (Germany), [2]University of Konstanz (Germany), and [3]Monash University (Australia)*

9:50   SD&A-192

Immersive analysis and visualization of redox signaling pathways integrating experiments and computational modelling, *Alexandre Maes[1], Karen Druart[2], Sean Guégan[2], Xavier Martinez[2,3], Christophe Marchand[1], Stéphane Lemaire[1], and Marc Baaden[2]; [1]Institut de Biologie Physico-Chimique, UMR8226, CNRS, Sorbonne Universités, UPMC Université Paris 06, [2]Laboratoire de Biochimie Théorique, CNRS, UPR9080, Univ Paris Diderot, Sorbonne Paris Cité, PSL Research University, and [3]CNRS-LIMSI, VENISE team, Univ Paris-Sud (France)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:50 am   Coffee Break

12:30 – 2:00 pm   Lunch

Plenary Session

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

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm   Coffee Break

Discussion: 360° Imaging Should Be 3D – But Why And How? **JOINT SESSION**
3:30 – 4:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.
NOTE: Full list of panelists to be announced.

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 2
JOINT SESSION

Session Chair: Marc Baaden, IBPC (France)

4:30 – 5:10 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

4:30   SD&A-288

Interactive molecular graphics for augmented reality using HoloLens, *Christoph Müller, Michael Krone, Markus Huber, Verena Biener, Guido Reina, Daniel Weiskopf, and Thomas Ertl, University of Stuttgart (Germany)*

4:50   SD&A-289

Molecular Dynamics Visualization (MDV): Stereoscopic 3D display of biomolecular structure and interactions using the Unity game engine, *Michael Wiebrands, Chris Malajczuk, Andrew Woods, Andrew Rohl, and Ricardo Mancera, Curtin University (Australia)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

10:00 am – 4:00 pm   Industry Exhibition

Keynote: Immersive Imaging `JOINT SESSION`
Session Chair: Gordon Wetzstein, Stanford Univ. (United States)
10:40 – 11:20 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

PMII-320

Real-time capture of people and environments for immersive computing, *Shahram Izadi, perceptiveIO, Inc. (United States)*

Dr. Shahram Izadi is co-founder and CTO of perceptiveIO, a new Bay Area startup working on bleeding-edge research and products at the intersection of real-time computer vision, applied machine learning, novel displays, sensing, and human-computer interaction. Prior to perceptiveIO, Dr. Izadis was a research manager at Microsoft, managing a team of researchers and engineers, called Interactive 3D Technologies, working on moonshot projects in the area of augmented and virtual reality and natural user interfaces.

Immersive Imaging `JOINT SESSION`

Session Chair: Gordon Wetzstein, Stanford Univ. (United States)

11:20 am – 12:40 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

11:20   PMII-350

SpinVR: Towards live-streaming 3D virtual reality video, *Donald Dansereau, Robert Konrad, Aniq Masood, and Gordon Wetzstein, Stanford University (United States)*

11:40   PMII-351

Towards a full parallax cinematic VR system, *Haricharan Lakshman, Dolby Labs (United States)*

12:00   PMII-352

Perceptual evaluation of six degrees of freedom virtual reality rendering from stacked omnistereo representation, *Jayant Thatte and Bernd Girod, Stanford University (United States)*

12:20   PMII-353

Image systems simulation for 360° camera rigs, *Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

12:40 – 2:00 pm   Lunch

Plenary Session

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

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm   Coffee Break

Visualization Facilities `JOINT SESSION`

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Andrew Woods, Curtin University (Australia)

3:30 – 5:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

3:30   ERVR-392 [no paper]

xREZ Art + Science Lab - facilities presentation, *Ruth West, University of North Texas (United States)*

3:50   SD&A-393

CADwalk: Life-size MR-AR-VR design experience – Optimising and validating mission critical work environments, *Gerhard Kimenkowski, CADwalk Global Pty Ltd. (Australia)*

4:10   ERVR-394 [no paper]

When one is not enough: Cross-platform and collaborative developments at the Emerging Analytics Center, *Dirk Reiners, Carolina Cruz-Neira, and Carsten Neumann, University of Arkansas at Little Rock (United States)*

4:30   SD&A-395

Multiplatform VR case study – Beacon Virtua, *Andrew Woods[1], Nick Oliver[1], and Paul Bourke[2]; [1]Curtin University and [2]University of Western Australia (Australia)*

4:50   SD&A-396

What will we see next? Current visualization facilities trends and future considerations, *Kurt Hoffmeister, Mechdyne Corp. (United States)*

5:10

SD&A Closing Remarks

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

Keynote: Dr. Jason Leigh
Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

9:00 – 10:10 am
Cypress C
ERVR Conference Introduction

ERVR-475 [no paper]

Surfing the wave of virtual reality and my cybercanoe, *Jason Leigh, University of Hawaii Manoa (United States)*

Dr. Jason Leigh is the director at the Laboratory for Advanced Visualization and Applications (LAVA), University of Hawai'i at Mānoa; and director emeritus of the Electronic Visualization Lab, University of Illinois at Chicago. He is a Fellow of the Institute for Health Research and Policy, and he has held research appointments at Argonne National Laboratory, and the National Center for Supercomputing Applications. Prof. Leigh's research expertise includes: Big data visualization; virtual reality; high performance networking; and video game design. He is co-inventor of the CAVE2 Hybrid Reality Environment, and SAGE: Scalable Adaptive Graphics Environment software, which has been licensed to Mechdyne Corporation & Vadiza Corporation, respectively. In 2010 he initiated a new multi-disciplinary area of research called Human Augmentics - which refers to the study of technologies for expanding the capabilities and characteristics of humans. Leigh teaches classes in software design and he has been teaching video game design for over 10 years. In 2010, his video game design class enabled the University of Illinois at Chicago to be ranked among the top 50 video game programs in the US and Canada.

10:10 – 10:50 am   Coffee Break

Living the Vida VR! Presence and Being in VR!

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

10:50 am – 12:30 pm
Cypress C

10:50   ERVR-432

Farmooo, a virtual reality farm simulation game designed for cancer pediatric patients to distract their pain during chemotherapy treatment, *Janice Ng, Henry Lo, Xin Tong, Diane Gromala, and Weina Jin, Simon Fraser University (Canada)*

11:10   ERVR-433

Presence in virtual reality: Insights from fundamental and applied research, *Daniel Mestre, Aix Marseille University, CNRS, ISM/CRVM (France)*

11:30   ERVR-434

From being there to feeling real: The effect of real world expertise and technology familiarity on presence in virtual environments, *Max J. Parola, Ruth West, Richard Herrington, Claire Adams, Molly Beyer, Ben Davis, Kathryn Hays, Luke Hillard, Meghan Kajihara, Zain Khoja, Brandon Lane, Nicholas Ligon, Danielle Poyser, Ganesh Thyagarajan, and Jonathan Starkweather, University of North Texas (United States)*

11:50   ERVR-435

A neuroscientific approach to exploring fundamental questions in VR, *Alex Wade[1], Cade McCall[1], Theodoros Karapanagiotidis[1], Guy Schofield[1], Catherine Preston[1], Tom Hartley[1], Milena Kaestner[1], Aidan Horner[1], Ryan Maloney[1], Jonny Smallwood[1], Elizabeth Jefferies[1], Marina Bloj[2], and Julie Harris[3]; [1]The University of York, [2]University of Bradford, and [3]University of Saint Andrews (United Kingdom)*

12:10   ERVR-437 [no paper]

Exploring landscapes and their implications for virtual reality, *Margaret Dolinsky, Indiana University (United States)*

<div align="center">

12:30 – 2:00 pm   Lunch

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Look at Me Now! VR Applications!

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

2:00 – 3:20 pm
Cypress C

2:00   ERVR-449

Experiencing a slice of the sky: Immersive rendering and sonification of Antarctic astronomy data, *Ruth West[1], Violet Johnson[1], I Chen Yeh[1], Zach Thomas[1], Michael Tarlton[1], and Eitan Mendelowitz[2]; [1]University of North Texas and [2]Mount Holyoke College (United States)*

2:20   ERVR-450

Continuous-motion text input in virtual reality, *Janis Jimenez and Jürgen Schulze, Univ. of California, San Diego (United States)*

2:40   ERVR-451

Virtual reality for sensor data visualization and analysis, *Artur Baltabayev[1], Alexej Gluschkow[1], Johannes Blank[1], Gero Birkhölzer[1], Jean Buesche[1], Martin Kern[1], Fabian Klopfer[1], Lisa-Maria Mayer[1], Gabriel Scheibler[1], Karsten Klein[1,2], Falk Schreiber[1,2], and Björn Sommer[1,2]; [1]University of Konstanz (Germany) and [2]Monash University (Australia)*

3:00   ERVR-452

Seeing the past: An augmented reality application for visualization the previous state of cultural heritage locations, *Piotr Siekanski[1], Eryk Bunsch[2], and Robert Sitnik[1]; [1]Warsaw University of Technology and [2]Museum of King Jan III's Palace at Wilanów (Poland)*

<div align="center">

3:20 – 3:50 pm   Coffee Break

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Get 'er Done! In VR!

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

3:50 – 5:00 pm
Cypress C

3:50   ERVR-468

Evaluating commodity hardware and software for virtual reality assembly training, *Emma Dodoo[1], Brittney Hill[2], Austin Garcia[3], Adam Kohl[3], Anastacia MacAllister[3], Jonathan Schlueter[3], and Eliot Winer[3]; [1]Pennsylvania State University, [2]Georgia State University, and [3]Iowa State University (United States)*

4:10   ERVR-469

An authoring system for VR-based firefighting commanders training, *Diego Puel[1], Paolo Busetta[1], and Nicola Conci[2]; [1]Delta Informatica and [2]Università degli Studi di Trento (Italy)*

4:30   ERVR-470

Analysis of video image based element for motion sickness, *Jaephil Lee[1], Seonyoung Lim[1], Jeonghyun Ahn[1], Yongwoo Yi[2], and HyungSeok Kim[1]; [1]Konkuk University and [2]Samsung Display (Republic of Korea)*

4:50

Conference Chair Closing Remarks