

2019 IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR 2019)

**San Diego, California, USA
9 – 11 December 2019**



IEEE Catalog Number: CFP19O53-POD
ISBN: 978-1-7281-5605-7

**Copyright © 2019 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

| | |
|-------------------------|-------------------|
| IEEE Catalog Number: | CFP19O53-POD |
| ISBN (Print-On-Demand): | 978-1-7281-5605-7 |
| ISBN (Online): | 978-1-7281-5604-0 |

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

2019 IEEE International Conference on Artificial Intelligence and Virtual Reality

(AI VR)

AI VR 2019

Table of Contents

| | |
|---|---------|
| Message from the General Co-Chairs | .xiii |
| Message from the Program Co-Chairs | .xv |
| Organizing Committee | .xvii |
| Program Committee | .xix |
| Keynotes | .xxi |
| Sponsors | .xxviii |

Full Papers

| | |
|--|-----|
| Collaborative Virtual Reality for Laparoscopic Liver Surgery Training | .1 |
| <i>Vuthea Chheang (Otto-von-Guericke University), Patrick Saalfeld (Otto-von-Guericke University), Tobias Huber (University Medicine of the Johannes Gutenberg-University), Florentine Huettl (University Medicine of the Johannes Gutenberg-University), Werner Kneist (University Medicine of the Johannes Gutenberg-University), Bernhard Preim (Otto-von-Guericke University), and Christian Hansen (Otto-von-Guericke University)</i> | |
| Combining Pairwise Feature Matches from Device Trajectories for Biometric Authentication in Virtual Reality Environments | .9 |
| <i>Ashwin Ajit (Clarkson University), Natasha Kholgade Banerjee (Clarkson University), and Sean Banerjee (Clarkson University)</i> | |
| Effects of Patient Care Assistant Embodiment and Computer Mediation on User Experience | .17 |
| <i>Kangsoo Kim (University of Central Florida), Nahal Norouzi (University of Central Florida), Tiffany Losekamp (University of Central Florida), Gerd Bruder (University of Central Florida), Mindi Anderson (University of Central Florida), and Gregory Welch (University of Central Florida)</i> | |
| Exploring Perspective Dependency in a Shared Body with Virtual Supernumerary Robotic Arms | .25 |
| <i>Ryo Takizawa (Keio University), Adrien Verhulst (The University of Tokyo), Katie Seaborn (RIKEN AIP), Masaaki Fukuoka (Keio University), Atsushi Hiyama (The University of Tokyo), Michiteru Kitazaki (Toyohashi University of Technology), Masahiko Inami (The University of Tokyo), and Maki Sugimoto (Keio University)</i> | |

| | |
|--|----------|
| Measuring User Responses to Driving Simulators: A Galvanic Skin Response Based Study | .33..... |
| <i>Atiqul Islam (Australian National University), Jinshuai Ma (Australian National University), Tom Gedeon (Australian National University), Md Zakir Hossain (Australian National University), and Ying-Hsang Liu (Australian National University)</i> | |
| Non-Verbal Behavior Generation for Virtual Characters in Group Conversations | .41..... |
| <i>Ferdinand de Coninck (Utrecht University), Zerrin Yumak (Utrecht University), Guntur Sandino (CleVR B.V.), and Remco Veltkamp (Utrecht University)</i> | |
| The Role of Virtual Reality in Autonomous Vehicles' Safety | .50..... |
| <i>Alexandre M. Nascimento (Stanford University), Anna Carolina M. Queiroz (Stanford University), Lucio F. Vismari (University of São Paulo), Jeremy N. Bailenson (Stanford University), Paulo S. Cugnasca (University of São Paulo), João B. Camargo Junior (University of São Paulo), and Jorge R. de Almeida Jr (University of São Paulo)</i> | |
| Unsupervised Learning of Depth and Ego-Motion From Cylindrical Panoramic Video | .58..... |
| <i>Alisha Sharma (Naval Research Laboratory) and Jonathan Ventura (California Polytechnic State University)</i> | |
| Using Eye Tracked Virtual Reality to Classify Understanding of Vocabulary in Recall Tasks | .66..... |
| <i>Jason Orlosky (Osaka University), Brandon Huynh (Osaka University), and Tobias Hollerer (University of California Santa Barbara)</i> | |
| Viewport Forecasting in 360° Virtual Reality Videos with Machine Learning | .74..... |
| <i>Johanna Vielhaben (Fraunhofer Heinrich-Hertz-Institute), Hüseyin Camalan (Fraunhofer Heinrich-Hertz-Institute), Wojciech Samek (Fraunhofer Heinrich-Hertz-Institute), and Markus Wenzel (Fraunhofer Heinrich-Hertz-Institute)</i> | |

Invited Full Papers

| | |
|--|----------|
| Immersive Analysis of 3D Multi-Cellular In-Vitro and In-Silico Cell Cultures | .82..... |
| <i>Andreas Knoté (Würzburg University), Sabine C. Fischer (Würzburg University), Sylvain Cussat-Blanc (Université Toulouse 3), Florian Niebling (Würzburg University), David Bernard (Université Toulouse 3), Florian Cogoni (Université Toulouse 1), and Sebastian von Mammen (Würzburg University)</i> | |
| Temporal Interpolation of Dynamic Digital Humans using Convolutional Neural Networks | .90..... |
| <i>Irene Viola (Centrum Wiskunde & Informatica), Jelmer Mulder (Centrum Wiskunde & Informatica), Francesca De Simone (Centrum Wiskunde & Informatica), and Pablo Cesar (Centrum Wiskunde & Informatica, TU Delft)</i> | |

Special Session "VR Experiences and Applications"

| | |
|--|----------|
| A Book Without Pages: Developing an Augmented Reality Storyteller Based on Open Web Data | .98..... |
| <i>Panote Siriaraya (Kyoto Institute of Technology), Kiriu Takumi (Kyoto Sangyo University), Yukiko Kawai (Kyoto Sangyo University, Osaka University), and Shinsuke Nakajima (Kyoto Sangyo University)</i> | |

| | |
|---|--|
| A Live Storytelling Virtual Reality System with Programmable Cartoon-Style Emotion Embodiment .102..... | |
| <i>Zhenjie Zhao (Hong Kong University of Science and Technology), Feng Han (Hong Kong University of Science and Technology), and Xiaojuan Ma (Hong Kong University of Science and Technology)</i> | |
| AR Food Changer using Deep Learning And Cross-Modal Effects .110..... | |
| <i>Junya Ueda (Yokohama National University) and Katsunori Okajima (Yokohama National University)</i> | |
| Kinematically Adaptive Exergames: Personalizing Exercise Therapy Through Closed-Loop Systems .118..... | |
| <i>John E. Muñoz (University of Waterloo), Shi Cao (University of Waterloo), and Jennifer Boger (University of Waterloo)</i> | |
| Open-Source Physiological Computing Framework using Heart Rate Variability in Mobile Virtual Reality Applications .126..... | |
| <i>Luis Quintero (Stockholm University), Panagiotis Papapetrou (Stockholm University), and John E. Muñoz (University of Waterloo)</i> | |

Special Session "Immersive Analytics"

| | |
|---|--|
| Coordinate: A Spreadsheet-Programmable Augmented Reality Framework for Immersive Map-Based Visualizations .134..... | |
| <i>Aashiq Shaikh (Arizona State University), Linda Nguyen (Arizona State University), Alireza Bahremand (Arizona State University), Hannah Bartolomea (Arizona State University), Frank Liu (Arizona State University), Van Nguyen (Arizona State University), Derrick Anderson (Arizona State University), and Robert LiKamWa (Arizona State University)</i> | |
| DatAR: Your Brain, Your Data, On Your Desk - A Research Proposal .138..... | |
| <i>Ghazaleh Tanhaei (Utrecht University), Lynda Hardman (Utrecht University), and Wolfgang Huerst (Utrecht University)</i> | |
| Immersive Analytics of Large Dynamic Networks via Overview and Detail Navigation .144..... | |
| <i>Johannes Sorger (Complexity Science Hub Vienna), Manuela Waldner (TU Wien), Wolfgang Knecht (Complexity Science Hub Vienna), and Alessio Arleo (TU Wien)</i> | |
| Using Visualization of Convolutional Neural Networks in Virtual Reality for Machine Learning Newcomers .152..... | |
| <i>Nadine Meissler (German Aerospace Center (DLR)), Annika Wohlan (German Aerospace Center (DLR)), Nico Hochgeschwender (German Aerospace Center (DLR)), and Andreas Schreiber (German Aerospace Center (DLR))</i> | |

Short Papers

| | |
|---|--|
| ATVR: An Attention Training System using Multitasking and Neurofeedback on Virtual Reality Platform .159..... | |
| <i>Menghe Zhang (University of California, San Diego), Junsong Zhang (Xiamen University), and Dong Zhang (Shandong Academy of Sciences)</i> | |
| Deep Learning on VR-Induced Attention .163..... | |
| <i>Gang Li (Shanghai Jiao Tong University) and Muhammad Adeel Khan (Shanghai Jiao Tong University)</i> | |

| | |
|---|--|
| Remote Environment Exploration with Drone Agent and Haptic Force Feedback .167..... | |
| <i>Tinglin Duan (University of Toronto), Parinya Punpongsanon (Osaka University), Sheng Jia (University of Toronto), Daisuke Iwai (Osaka University), Kosuke Sato (Osaka University), and Konstantinos N. Plataniotis (University of Toronto)</i> | |
| Situation-Adaptive Object Grasping Recognition in VR Environment .171..... | |
| <i>Koki Hirota (Saitama University) and Takashi Komuro (Saitama University)</i> | |

Poster Papers

| | |
|--|--|
| AR Tracking with Hybrid, Agnostic And Browser Based Approach .175..... | |
| <i>Amit L. Ahire (Fraunhofer IGD) and Dennis Basgier (Fraunhofer IGD)</i> | |
| Assessing the Value of 3D Software Experience with Camera Layout in Virtual Reality .179..... | |
| <i>Daniel Hawes (Carleton University), Rob Teather (Carleton University), Ali Arya (Carleton University), and Max Krichenbauer (Marui Plugin)</i> | |
| Exploring CNN-Based Viewport Prediction for Live Virtual Reality Streaming .183..... | |
| <i>Xianglong Feng (Rutgers University), Zeyang Bao (Rutgers University), and Sheng Wei (Rutgers University)</i> | |
| Extracting Specific Voice from Mixed Audio Source .187..... | |
| <i>Kunihiko Sato (LINE Corporation)</i> | |
| Towards Method Time Measurement Identification Using Virtual Reality and Gesture Recognition .191..... | |
| <i>Abdelkader Bellarbi (IRIT, University of Toulouse 3), Jean-Pierre Jessel (IRIT, University of Toulouse 3), and Laurent Da Dalto (Mimbus)</i> | |
| Vibration Feedback Controlled by Intuitive Pressing in Virtual Reality .195..... | |
| <i>Yu-Wei Wang (National Taiwan University), Tse-Yu Pan (National Tsing Hua University), Yung-Ju Chang (National Chiao Tung University), and Min-Chun Hu (National Tsing Hua University)</i> | |
| VRescuer: A Virtual Reality Application for Disaster Response Training .199..... | |
| <i>Vinh T. Nguyen (Texas Tech University), Kwanghee Jung (Texas Tech University), and Tommy Dang (Texas Tech University)</i> | |

Invited Poster Papers

| | |
|---|--|
| A Case Study on Visual-Inertial Odometry using Supervised, Semi-Supervised and Unsupervised Learning Methods .203..... | |
| <i>Yuan Tian (Embry-Riddle Aeronautical University) and Marc Compere (Embry-Riddle Aeronautical University)</i> | |
| Binarization Using Morphological Decomposition Followed by cGAN .208..... | |
| <i>Cheng-Pan Hsieh (National Taiwan Ocean University), Shih-Kai Lee (National Taiwan Ocean University), Ya-Yi Liao (National Taiwan Ocean University), Ren-Jie Huang (National Taiwan Ocean University), and Jung-Hua Wang (National Taiwan Ocean University)</i> | |
| Creating Virtual Reality and Augmented Reality Development in Classroom: Is it a Hype? .212..... | |
| <i>Vinh T. Nguyen (Texas Tech University), Kwanghee Jung (Texas Tech University), and Tommy Dang (Texas Tech University)</i> | |

| | |
|--|--|
| Intent Inference of Human Hand Motion for Haptic Feedback Systems .218..... | |
| <i>Mengyi Zhao (Beihang University) and Shuling Dai (Beihang University)</i> | |
| Towards Semantic Action Analysis via Emergent Language .224..... | |
| <i>Alberto Santamaria-Pang (General Electric Research), James R. Kubricht (General Electric Research), Chinmaya Devaraj (University of Maryland), Aritra Chowdhury (General Electric Research), and Peter Tu (General Electric Research)</i> | |
| Using CNNs For Users Segmentation In Video See-Through Augmented Virtuality .229..... | |
| <i>Pierre-Olivier Pigny (CLARTE) and Lionel Dominjon (CLARTE)</i> | |

Demonstration and Video Papers

| | |
|---|--|
| An Affective Computing in Virtual Reality Environments for Managing Surgical Pain and Anxiety .235..... | |
| <i>Vishnunarayanan G Prabhu (Clemson University), Courtney Linder (Clemson University), Laura M Stanley (Montana State University), and Robert Morgan (Prisma Health - Upstate)</i> | |
| Creating an Immersed Sheep and Wool VR/AI Experience .237..... | |
| <i>Helen X. Trejo (California State Polytechnic University, Pomona)</i> | |
| Drafting Interpretation of Seismic Data through Virtual Reality with Hyperknowledge Base Systems .239..... | |
| <i>Wallas Santos (IBM Research), Isabela Chambers (IBM Research), Emilio Vital Brazil (IBM Research), and Marcio Moreno (IBM Research)</i> | |
| Extended Abstract: Augmented Reality for Human-Robot Cooperation in Aircraft Assembly .241..... | |
| <i>Andreas Luxenburger (German Research Center for Artificial Intelligence (DFKI GmbH)), Jonas Mohr (German Research Center for Artificial Intelligence (DFKI GmbH)), Torsten Spieldennner (German Research Center for Artificial Intelligence (DFKI GmbH)), Dieter Merkel (German Research Center for Artificial Intelligence (DFKI GmbH)), Fabio Espinosa (German Research Center for Artificial Intelligence (DFKI GmbH)), Tim Schwartz (German Research Center for Artificial Intelligence (DFKI GmbH)), Florian Reinicke (Broetje Automation GmbH), Julian Ahlers (Broetje Automation GmbH), and Markus Stoyke (Broetje Automation GmbH)</i> | |
| HoloLucination: A Framework for Live Augmented Reality Presentations Across Mobile Devices .243..... | |
| <i>Alireza Bahremand (Arizona State University), Linda Nguyen (Arizona State University), Tanya Harrison (Professional Martian), and Robert LiKamWa (Arizona State University)</i> | |
| neomento SAD - VR Treatment For Social Anxiety .245..... | |
| <i>Adam Streck (Deutsches Zentrum für Neurodegenerative Erkrankungen), Philipp Stepnicka (Deutsches Zentrum für Neurodegenerative Erkrankungen), Jens Klaubert (Deutsches Zentrum für Neurodegenerative Erkrankungen), and Thomas Wolbers (Deutsches Zentrum für Neurodegenerative Erkrankungen)</i> | |

Demonstration and Video Papers Accompanying Full or Short Papers

- An Interactive Demonstration of Collaborative VR for Laparoscopic Liver Surgery Training .247.....
Vuthea Chheang (Otto-von-Guericke University), Patrick Saalfeld (Otto-von-Guericke University), Tobias Huber (University Medicine of the Johannes Gutenberg-University), Florentine Huettl (University Medicine of the Johannes Gutenberg-University), Werner Kneist (University Medicine of the Johannes Gutenberg-University), Bernhard Preim (Otto-von-Guericke University), and Christian Hansen (Otto-von-Guericke University)
- Explore Convolutional Neural Networks in Virtual Reality .249.....
Nadine Meissler (German Aerospace Center (DLR)), Annika Wohlan (German Aerospace Center (DLR)), Nico Hochgeschwender (German Aerospace Center (DLR)), and Andreas Schreiber (German Aerospace Center (DLR))
- Live Emoji: A Live Storytelling VR System with Programmable Cartoon-Style Emotion Embodiment .251.....
Zhenjie Zhao (Hong Kong University of Science and Technology), Feng Han (Hong Kong University of Science and Technology), and Xiaojuan Ma (Hong Kong University of Science and Technology)
- Realtime Behavior-Based Continual Authentication of Users in Virtual Reality Environments .253.....
Robert Miller (Clarkson University), Ashwin Ajit (Clarkson University), Natasha Kholgade Banerjee (Clarkson University), and Sean Banerjee (Clarkson University)
- Video Demo: Unsupervised Learning of Depth and Ego-Motion from Cylindrical Panoramic Video .255.....
Alisha Sharma (Naval Research Laboratory) and Jonathan Ventura (California Polytechnic State University)

Invited Demonstration and Video Papers

- DroneVR: A Web Virtual Reality Simulator for Drone Operator .257.....
Vinh T. Nguyen (Texas Tech University), Kwanghee Jung (Texas Tech University), and Tommy Dang (Texas Tech University)

Industry Papers

- Augmented Reality for Human-Robot Cooperation in Aircraft Assembly .263.....
Andreas Luxenburger (German Research Center for Artificial Intelligence (DFKI GmbH)), Jonas Mohr (German Research Center for Artificial Intelligence (DFKI GmbH)), Torsten Spielenner (German Research Center for Artificial Intelligence (DFKI GmbH)), Dieter Merkel (German Research Center for Artificial Intelligence (DFKI GmbH)), Fabio Espinosa (German Research Center for Artificial Intelligence (DFKI GmbH)), Tim Schwartz (German Research Center for Artificial Intelligence (DFKI GmbH)), Florian Reinicke (Broetje-Automation GmbH), Julian Ahlers (Broetje-Automation GmbH), and Markus Stoyke (Broetje-Automation GmbH)
- Room Style Estimation for Style-Aware Recommendation .267.....
Esra Ataer-Cansizoglu (Wayfair), Hantian Liu (Wayfair), Tomer Weiss (Wayfair), Archi Mitra (Wayfair), Dhaval Dholakia (Wayfair), Jae-Woo Choi (Wayfair), and Dan Wulin (Wayfair)

Structuring and Inspecting 3D Anchors for Seismic Volume into Hyperknowledge Base in Virtual Reality .271..

Wallas Santos (IBM Research), Isabela Chambers (IBM Research), Emilio

Vital Brazil (IBM Research), and Marcio Moreno (IBM Research)

Workshop "Ethics in AR and XR (AIXR)"

Extending Socio-Technological Reality for Ethics in Artificial Intelligent Systems .275.....

Nadisha-Marie Aliman (Utrecht University) and Leon Kester (TNO Netherlands)

XR for Augmented Utilitarianism .283.....

Nadisha-Marie Aliman (Utrecht University), Leon Kester (TNO Netherlands), and Peter Werkhoven (Utrecht University)

Workshop "From Capture to Rendering of Digital Humans for AR/VR (CRDH)"

Influence of Motion Speed on the Perception of Latency in Avatar Control .286.....

Ludovic Hoyet (Inria, Univ Rennes, CNRS, IRISA), Clément Spies (Inria, Univ Rennes, CNRS, IRISA), Pierre Plantard (Univ Rennes, Inria, M2S), Anthony Sorel (Univ Rennes, Inria, M2S), Richard Kulpa (Univ Rennes, Inria, M2S), and Franck Multon (Inria, Univ Rennes, CNRS, IRISA, M2S)

The Design Process for Enhancing Visual Expressive Qualities of Characters from Performance Capture into Virtual Reality .290.....

Victoria Campbell (The Ohio State University)

Workshop "Modeling and Animating Realistic Crowds and Humans (MARCH)"

Civil War Battlefield Experience: Historical Event Simulation using Augmented Reality Technology .294.....

Vinh T. Nguyen (Texas Tech University), Kwanghee Jung (Texas Tech University), SeungChul Yoo (Ewha Womans University), Seungman Kim (Texas Tech University), Sohyun Park (University of Connecticut), and Melissa Currie (Texas Tech University)

Crowd and Procession Hypothesis Testing for Large-Scale Archaeological Sites .298.....

Kristin Chow (University of Pennsylvania), Aline Normoyle (Swarthmore College), Jeanette Nicewinter (Northern Virginia Community College), Clark L. Erickson (University of Pennsylvania), and Norman I. Badler (University of Pennsylvania)

CrowdAR Table - An AR Table for Interactive Crowd Simulation .302.....

Wolfgang Hürst (Utrecht University), Roland Geraerts (Utrecht University), and Yiran Zhao (uCrowds)

Implementing Position-Based Real-Time Simulation of Large Crowds .306.....

Tomer Weiss (University of California, Los Angeles)

| | |
|---|--|
| Ubiquitous Virtual Humans: A Multi-Platform Framework for Embodied AI Agents in XR .308..... | |
| <i>Arno Hartholt (USC Institute for Creative Technologies), Ed Fast (USC Institute for Creative Technologies), Adam Reilly (USC Institute for Creative Technologies), Wendy Whitcup (USC Institute for Creative Technologies), Matt Liewer (USC Institute for Creative Technologies), and Sharon Mozgai (USC Institute for Creative Technologies)</i> | |

| | |
|-----------------------------------|--|
| Author Index 313 | |
|-----------------------------------|--|