Guest Editor’s Introduction: Special Section on the International Symposium on Mixed and Augmented Reality 2012

Maribeth Gandy, Kiyoshi Kiyokawa, and Gerhard Reitmayr

The IEEE International Symposium on Mixed and Augmented Reality continues to be the leading venue for publishing the latest Mixed and Augmented Reality research, applications, and technologies. This special section presents significantly extended versions of the four best papers of the IEEE ISMAR 2012 proceedings. These papers demonstrate the wide range of topics in Augmented Reality research.

IEEE ISMAR 2012 had 143 submissions; each paper was reviewed by at least four experts in the field. An international program committee of 15 AR experts invited reviewers, led discussions, invited a rebuttal by the paper authors and prepared a consensus review. To select the final papers for publication, an in-person two-day PC meeting was held, where each paper was discussed, resulting in an overall acceptance rate of 27 percent.

In an additional selection process, an independent Award Committee reviewed the 10 best ranked submissions again to determine the awards for Best Paper and Honorable Mention. For this special section, the authors of the award papers were invited to submit an extended version of their conference paper, with a clear focus on additional content that expands the scientific contribution of the original conference paper. A standard TVCG reviewing cycle was initiated and all four papers required multiple revisions and reviews.

Real-time camera pose tracking is a prerequisite for many augmented reality systems and applications. Unknown environments present the additional complication that no prior 3D models or other information is known to enable camera pose estimation. Methods from the domain of simultaneous localization and mapping have been successfully applied in recent years to demonstrate novel AR systems. In their paper “Model Estimation and Selection towards Unconstrained Real-Time Tracking and Mapping,” Steffen Gauglitz, Chris Sweeney, Jonathan Ventura, Matthew Turk, and Tobias Höllerer tackle an important short-comings of existing methods which would break down under constraint camera motion which would not allow to estimate 3D information. Through rigorous application of statistical model selection techniques, Gauglitz and his co-authors could show how to setup an estimation framework that seamlessly adapts to different camera motions.

The recent availability of inexpensive and powerful depth sensors such as the Kinect allowed researchers to push the possibilities of online 3D reconstruction and camera tracking far beyond the capabilities of normal camera systems. Paul McIlroy, Shahram Izadi and Andrew Fitzgibbon describe in their paper “Kinectrack: 3D Pose Estimation Using a Projected Dense Dot Pattern” a novel setup that uses the structured light pattern of a depth sensor projector directly to estimate the pose of the projector.

Low-level computer vision is also a common topic in augmented reality due to the need for fast, real-time and computationally inexpensive image processing algorithms. A recent trend in low-level feature description explores encoding single bit tests in a pixel neighborhood to uniquely identify a pixel location. In their paper “Learning Optimized Local Difference Binaries for Scalable Augmented Reality on Mobile Devices,” Yin Yang and Kwang-Ting Cheng apply machine learning methods to create optimized and binary descriptors which boost both recognition performance while reducing computational requirements.

Mixed and augmented reality also requires modifying and extending graphical output to the user. A common application is the removal of objects through inpainting techniques. Jan Herling and Wolfgang Broll extend in their paper “High-Quality Real-time Video Inpainting with PixMix” single image inpainting methods to work on a video stream. This requires additional temporal coherence over the spatial coherence of inpainting. Furthermore, mixed reality applications require real-time performance which is a second contribution of their work.

We thank the Awards Chair Mark Billinghurst for organizing the selection of the award papers and the members of the Award Committee for the additional reviews and final recommendations for the papers presented in this section. Finally, we thank all the reviewers who provided thoughtful and insightful comments through several iterations.
Maribeth Gandy received the BS degree in computer engineering, and the MS and PhD degrees in computer science from Georgia Tech. She is the director of the Interactive Media Technology Center and the associate director of Interactive Media in the Institute for People and Technology at Georgia Tech. In her AR research, she is interested in advancing AR as a new medium by focusing on authoring, evaluation, and deployment. She was the lead architect on a large open source software project called the Designer’s Augmented Reality Toolkit (DART), which had thousands of users and was used to create a variety of large-scale AR systems. She was also a co-PI on the US National Science Foundation (NSF) grant focused on the development of presence metrics for measuring engagement in AR environments using qualitative and quantitative data. She is currently collaborating on the creation of an open source AR web browser called Argon.

Kiyoshi Kiyokawa received the ME and PhD degrees in information systems from Nara Institute of Science and Technology in 1996 and 1998, respectively. He is currently an associate professor at Cybermedia Center, Osaka University. He was a research fellow of the Japan Society for the Promotion of Science in 1998. He was at Communications Research Laboratory from 1999 to 2002. He was a visiting researcher at Human Interface Technology Laboratory at the University of Washington from 2001 to 2002. His research interests include virtual reality, augmented reality, 3D user interface, and CSCW. He is currently a member of ISMAR Steering Committee, a board member of the Virtual Reality Society of Japan and a councilor of Human Interface Society, Japan.

Gerhard Reitmayr received the Dipl-Ing and Dr techn degrees in 2000 and 2004 from Vienna University of Technology. He is a principal engineer at Qualcomm Research Austria. He was a research associate at the Department of Engineering at the University of Cambridge, United Kingdom until May 2009, where he was a researcher and a principal investigator in industry and EC funded projects. From 2009 to 2013, he was a professor for augmented reality at Graz University of Technology. His research interests include the development of augmented reality user interfaces and computer vision methods on mobile devices for localisation, reconstruction, and interaction.

For more information on this or any other computing topic, please visit our Digital Library at www.computer.org/publications/dlib.