Guest Editor's Introduction to the Special Section on the International Symposium on Mixed and Augmented Reality 2013

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THE IEEE International Symposium on Mixed and Augmented Reality (ISMAR) is the leading venue for publishing the latest Mixed and Augmented Reality research, applications and technologies. This special section presents significantly extended versions of the best papers from the IEEE ISMAR 2013 proceedings. These papers consider two enduring themes of AR research—the development of the basic technology to support mixed and augmented reality experiences, and the ways in which these technologies can be used to create those experiences.

The first paper, "*Real-Time 3D Tracking and Reconstruction on Mobile Phones*" by Victor Prisacariu, Olaf Kahler, David Murray, and Ian Reid, considers the problems of creating 3D models and how these can be then used to track the motion of a camera. Considering the problem of reconstructing models in museums, the authors develop new algorithms which are capable of handling untextured objects, blur and other challenging conditions. Remarkably, these algorithms can be made to operate in real-time on smartphones, bringing the vision of ubiquitous, real-time AR one step closer.

The second paper, "*Real-Time RGB-D Camera Relocalization via Randomized Ferns for Keyframe Encoding*" by Ben Glocker, Jamie Shotton, Antonio Criminisi, and Shahram Izadi, considers the problem of developing robust, keyframe-based tracking systems. The dirty little secret of almost all tracking systems is that they will fail at some point. Although experts in AR systems can often recover from them, non-experts can become very confused and frustrated. This paper describes fast and effective mechanisms for recovering a tracking system when lost. It also proposes a way to automatically determine when a frame is a keyframe, rather than the heuristics of spatial and angular separation which are widely used.

The benefits of minimally invasive surgery have long been established. By providing an overlay of surgical information directly on a patient has the potential to improve the effectiveness of these procedures even further. The third paper, "*Impact of Soft Tissue Heterogeneity on Augmented Reality for Liver Surgery*" by Nazim Haouchine, Stephane Cotin, Igor Peterlik, Jeremie Dequidt, Mario Sanz Lopez, Erwan Kerrien and Marie-Odile Berger, considers how this can be achieved for the liver, where tissue deformation of both the parenchyma (functional mass) and the vessels must be represented appropriately. The system was demonstrated to work on both a phantom and on a live human patient.

As a therapeutic intervention, augmented reality has been used to treat phobias. However, the paper "*Using Augmented Reality to Elicit Pretend Play for Children with Autism*" by Zhen Bai, Alan F. Blackwell and George Coulouris shows that augmented reality can contribute in other ways, by promoting pretend play in children with autism spectrum condition (ASC). Researchers believe that children with ASC have difficulty in maintaining both imagined content and the real world at the same time. AR provides a way to visualize this imagined content. The paper extensively examines the implications and use of this technology and shows that significant benefits can be made.

Some of the earliest applications of mobile augmented reality were for situation awareness and training. In our final paper, "*Augmented Reality Binoculars*" by Taragay Oskiper; Mikhail Sizintsev, Vlad Branzoi, Supun Samarasekera, and Rakesh Kumar, the authors develop an augmented reality system to deliver virtual content to a pair of binoculars. The system combines a high-quality tracking system, which blends visual and inertial sensors together, to provide pixel-level registration accuracy in outdoor environments. A series of training examples using synthetic forces are shown.

IEEE ISMAR 2013 had 103 paper 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 online two-day PC meeting was held connecting three continents, where each paper was discussed, resulting in an overall acceptance rate of 25.2 percent.

An independent Award Committee reviewed the highest-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. One paper was

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immediately accepted in the first review cycle whereas the other four required multiple revisions and reviews.

The authors thank the Awards Chairs, Mark Billinghurst and Christian Sandor, 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.

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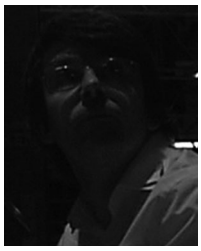
Guest Editors

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.



Simon Julier received the DPhil from the Robotics Research Group, the University of Oxford, United Kingdom. During the DPhil, he assisted Jeff Uhlmann in the development of both the Unscented Kalman Filter and Covariance Intersection fusion algorithms. He is a Reader in the Department of Computer Science, University College London. Between 1997 and 2006, he was at the Naval Research Laboratory, Washington DC, where he led a team to develop mobile augmented reality systems. Since 2006, he has been at UCL, where he has been developing algorithms for simultaneous localization mapping, augmented reality, and distributed data fusion. Recently, he has begun to study the use of negative information (lack of detections) in filtering and estimation problems.

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.